L Number	Hits	Search Text	DB	Time stamp
3	1086	(voip or (voice adj1 (IP or internet))) with (prox$4 or gateway)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:01
4	39798	pstn or switched adj2 network	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 20:54
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6	52801	(match or compar$3 or verif$5) near3 (token or cookie or flag or id or identif$6)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 20:55
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8	2	6252952.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:03
9	1525	(voip or (voice adj1 (IP or internet))) with call	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:27
10	336449	previleg$3 or priori$5	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:26
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18	81	((previleg$3 or priori$5) with call) same ((voip or (voice adj1 (IP or internet))))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:29

19	10	(((previleg$3 or priori$5) with call) same ((voip or (voice adj1 (IP or internet))))) not (((voip or (voice adj1 (IP or internet))) with call) same ((previleg$3 or priori$5) with call))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:28
21	317	((previleg$3 or priori$5) with call) and ((voip or (voice adj1 (IP or internet))))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:29
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23	1449	(voip or (voice adj1 (IP or internet))).ab.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:29
24	19	(((previleg$3 or priori$5) with call).ab.) and ((voip or (voice adj1 (IP or internet))).ab.)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:29
26	12635	((forward$3 or deliver$3 or transfer$3) with call).ab.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:34
27	210	(((previleg$3 or priori$5) with call).ab.) and (((forward$3 or deliver$3 or transfer$3) with call).ab.)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:34
29	13552	gateway.ab.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:35
30	22729	(((called or answering) near (individual or party or person)) or recipient).ab.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:36
31	13	((((previleg$3 or priori$5) with call).ab.) and (((forward$3 or deliver$3 or transfer$3) with call).ab.)) and ((((called or answering) near (individual or party or person)) or recipient).ab.)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:43
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33	2	5600704.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:49
34	839	379/201.01, 211.01.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:51
35	96	((previleg$3 or priori$5) with call) and (379/201.01, 211.01.ccls.)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:50

36	1082	455/445.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:50
37	94	((previleg$3 or priori$5) with call) and 455/445.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:50
38	118	379/144.01.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:51
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40	2533	370/352.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:52
41	245	((voip or (voice adj1 (IP or internet))) with (prox$4 or gateway)) and 370/352.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:52
42	222	(pstn or switched adj2 network) and (((voip or (voice adj1 (IP or internet))) with (prox$4 or gateway)) and 370/352.ccls.)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 21:52
43	12	((match or compar$3 or verif$5) near3 (token or cookie or flag or id or identif$6)) and ((pstn or switched adj2 network) and (((voip or (voice adj1 (IP or internet))) with (prox$4 or gateway)) and 370/352.ccls.))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:00
44	472	709/248.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:00
45	1	((voip or (voice adj1 (IP or internet))) with (prox$4 or gateway)) and 709/248.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:00
46	4637	(voip or (voice adj1 (IP or internet)))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:02
47	1276	(pstn or switched adj2 network) same ((voip or (voice adj1 (IP or internet))))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:02
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49	2296	(pstn or switched adj2 network) and ((voip or (voice adj1 (IP or internet))))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:02

50	1	709/248.ccls. and ((pstn or switched adj2 network) and ((voip or (voice adj1 (IP or internet)))))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:02

L Number	Hits	Search Text	DB	Time stamp
51	423	((match$3 or compar$3) with (token or cookie)) same server	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:31
52	26	(((match$3 or compar$3) with (token or cookie)) same server) same call	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:33
53	1124	709/204.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:36
54	1	((((match$3 or compar$3) with (token or cookie)) same server) same call) and 709/204.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:37
55	2080	709/227.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:37
56	5	((((match$3 or compar$3) with (token or cookie)) same server) same call) and 709/227.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/07/10 22:37

US005276731A

United States Patent [19]

Arbel et al.

[11] Patent Number: 5,276,731

[45] Date of Patent: Jan. 4, 1994

[54] **METHOD AND APPARATUS FOR HANDLING INCOMING TELEPHONE CALLS**

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[73] Assignee: **ROLM Company**, Santa Clara, Calif.

[21] Appl. No.: **692,081**

[22] Filed: **Apr. 26, 1991**

[51] Int. Cl.[5] H04M 1/66; H04M 3/42; H04M 11/00

[52] U.S. Cl. 379/88; 379/100; 379/142; 379/199; 379/201; 379/211

[58] Field of Search 379/88, 89, 67, 142, 379/201, 213, 127, 214, 211, 100, 199, 189, 188

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The New York Times; "Opening Nation's Phone Networks", E. L. Andrews; Jan. 16, 1991; p. D5.

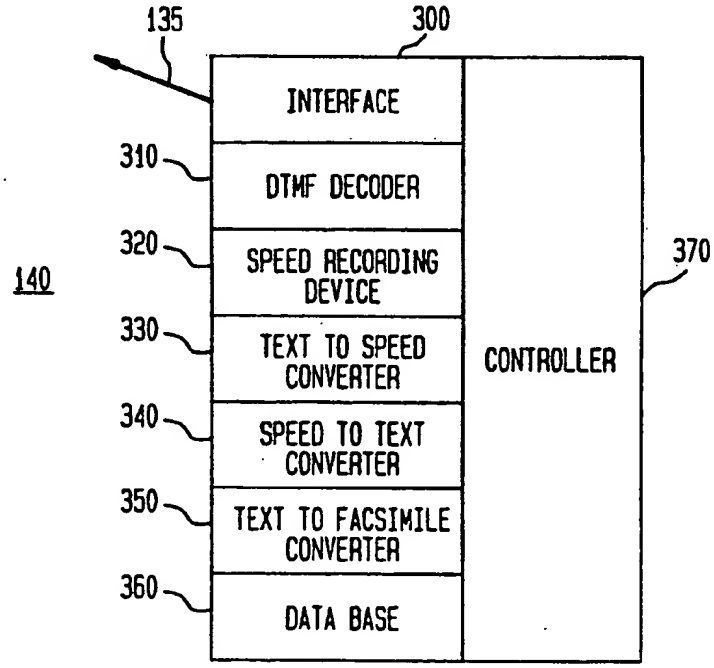
Primary Examiner—Thomas W. Brown

Attorney, Agent, or Firm—Michael B. Einschlag

[57] **ABSTRACT**

Method and apparatus for handling incoming telephone calls and, in particular: (a) for delivering predetermined messages to predetermined calling parties; (b) predetermined, prioritorized screening of incoming telephone calls; and (c) for re-routing incoming telephone calls on the basis of predetermined selection criteria. The predetermined selection criteria include information such as the calling parties, call origination information, call origination information with wildcards, time, date, or a combination of these factors. Call origination information includes, but is not limited to, Automatic Number Identification ("ANI"), private network tie line identification, trunk ID, Wide Area Telephone Service ("WATS"), and extension numbers.

18 Claims, 2 Drawing Sheets



US006741692B1

(12) **United States Patent**
Johnson

(10) **Patent No.: US 6,741,692 B1**
(45) **Date of Patent: *May 25, 2004**

(54) **METHOD OF AND SYSTEM FOR PRIORITY CALL PROCESSING BASED UPON ELECTRONIC MAIL STATUS**

(75) Inventor: **William J. Johnson**, Flower Mound, TX (US)

(73) Assignee: **WorldCom, Inc.**, Ashburn, VA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/466,024**

(22) Filed: **Dec. 17, 1999**

(51) **Int. Cl.**[7] **H04M 3/42**

(52) **U.S. Cl.** **379/211.01**; 379/201.08; 379/201.07; 379/201.01; 379/202.01

(58) **Field of Search** 379/211.01, 211.02

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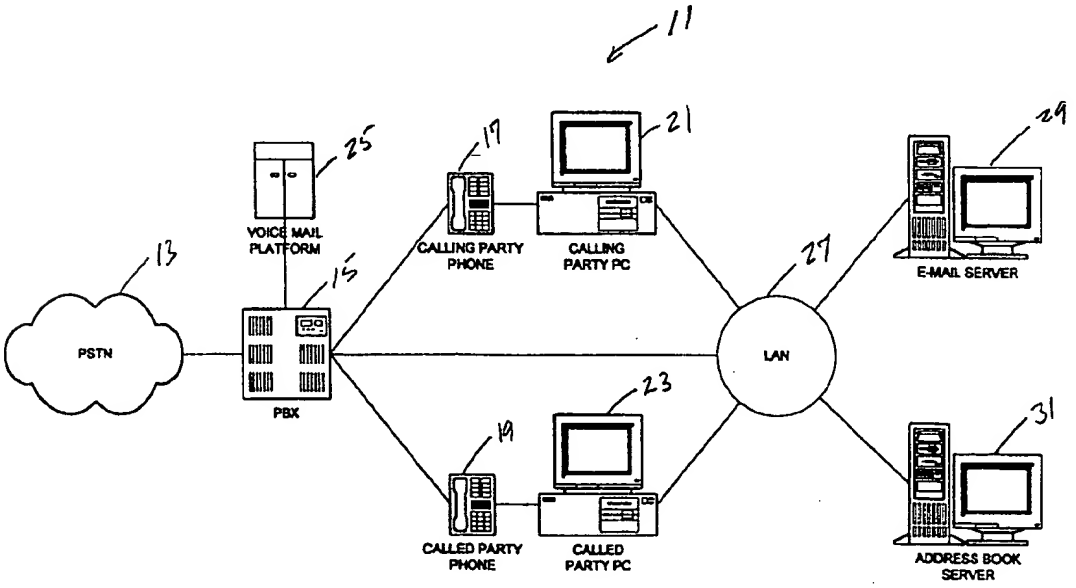
* cited by examiner

Primary Examiner—Ahmad F. Matar
Assistant Examiner—Karen Le

(57) **ABSTRACT**

A method of and system for providing priority call processing based upon the status of electronic mail items between a called party and a calling party receives a request to set up a call between the calling party and the called party and determines if the called party has priority call processing activated or enabled. If so, the system determines if there is a priority electronic mail item between the called party and the calling party. If so, the system provides special processing of the call.

28 Claims, 5 Drawing Sheets



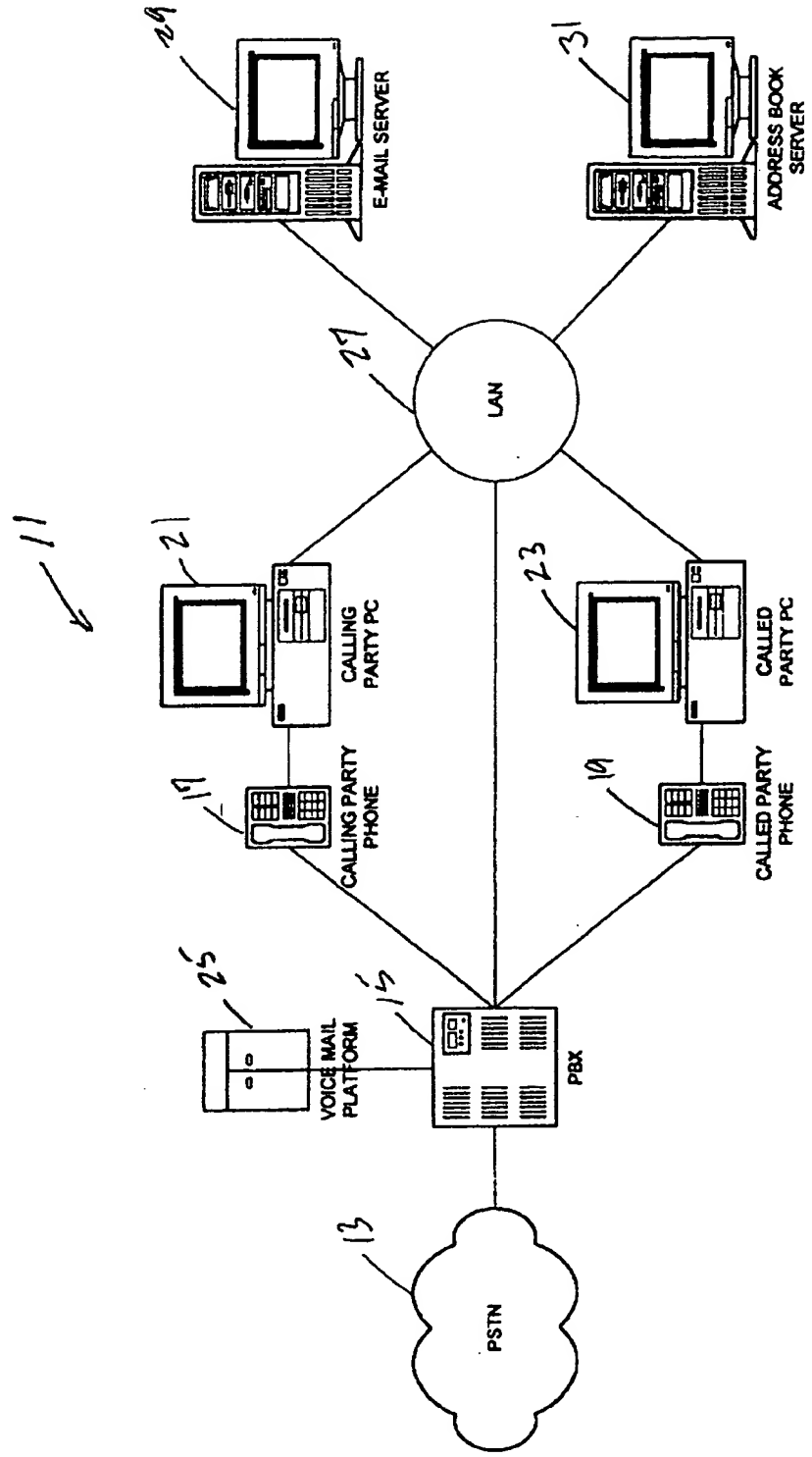

29
E-MAIL SERVER
31
ADDRESS BOOK SERVER
27
LAN
11
21
CALLING PARTY PC
23
CALLED PARTY PC
17
CALLING PARTY PHONE
19
CALLED PARTY PHONE
25
VOICE MAIL PLATFORM
15
PBX
13
PSTN

FIG. 1

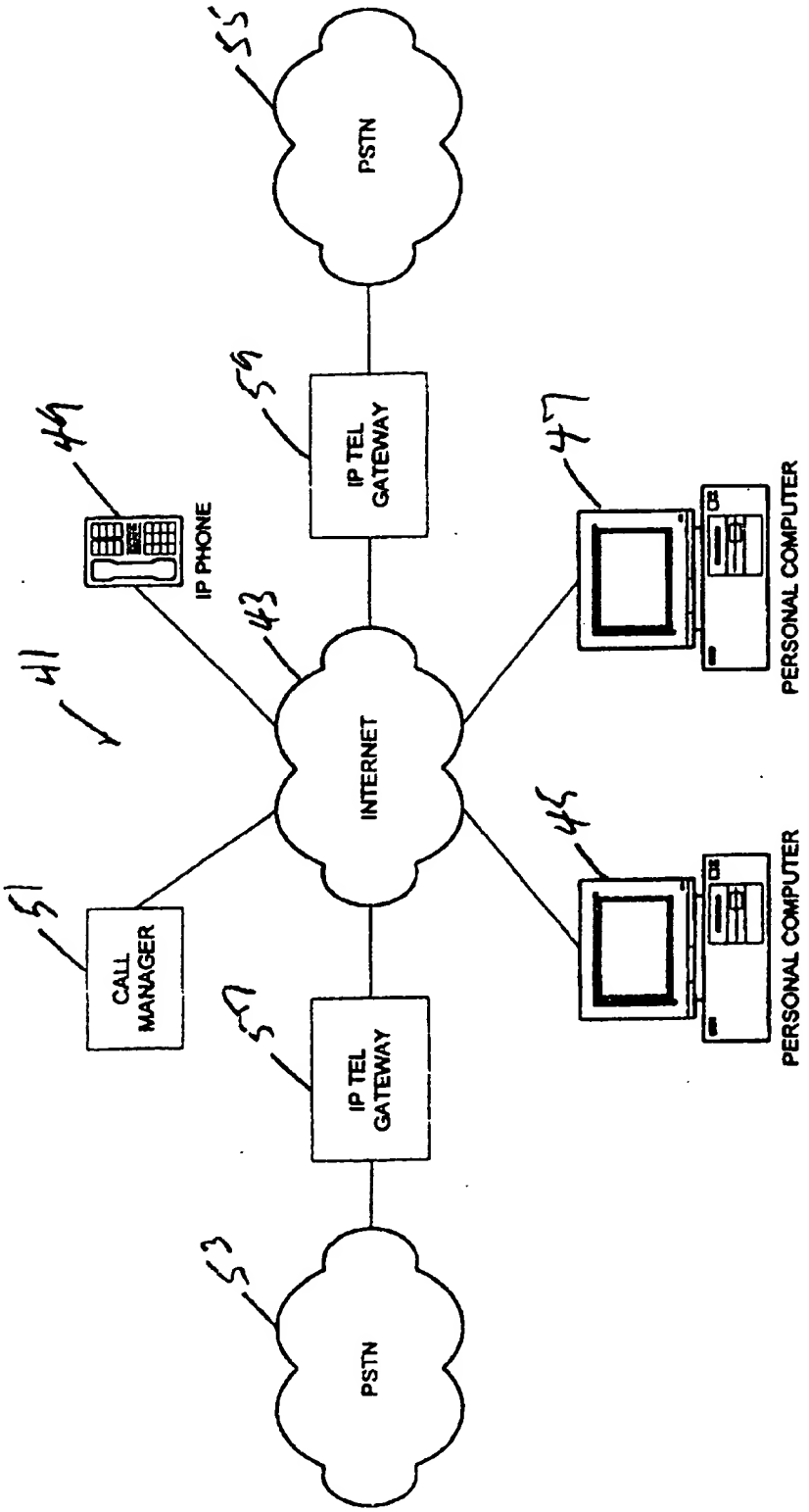

55
PSTN
59
IP TEL GATEWAY
49
IP PHONE
47
PERSONAL COMPUTER
41
43
INTERNET
45
PERSONAL COMPUTER
51
CALL MANAGER
57
IP TEL GATEWAY
53
PSTN

FIG. 2

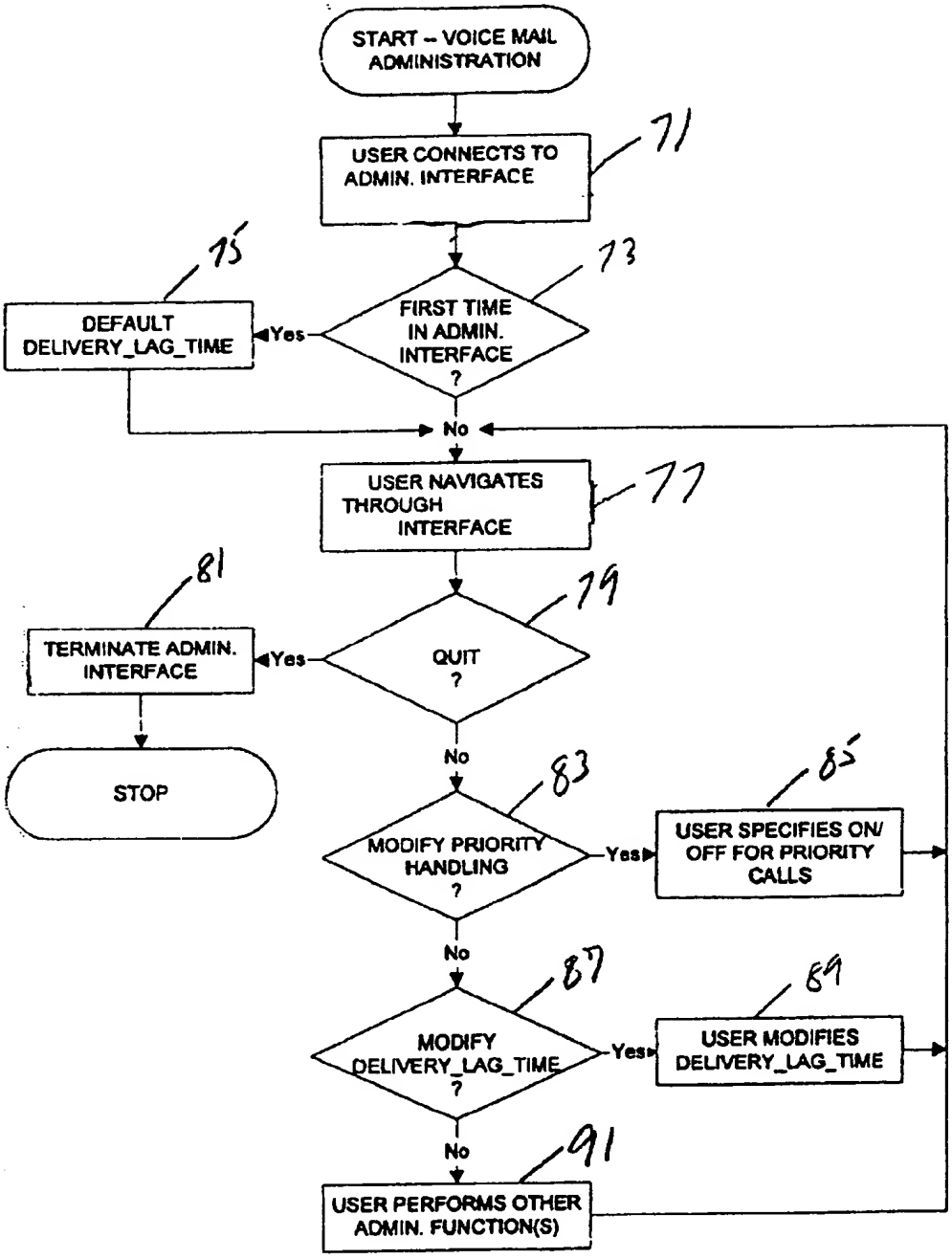

START – VOICE MAIL ADMINISTRATION
USER CONNECTS TO ADMIN. INTERFACE
71
FIRST TIME IN ADMIN. INTERFACE ?
73
Yes
DEFAULT DELIVERY_LAG_TIME
75
No
USER NAVIGATES THROUGH INTERFACE
77
QUIT ?
79
Yes
TERMINATE ADMIN. INTERFACE
81
STOP
No
MODIFY PRIORITY HANDLING ?
83
Yes
USER SPECIFIES ON/ OFF FOR PRIORITY CALLS
85
No
MODIFY DELIVERY_LAG_TIME ?
87
Yes
USER MODIFIES DELIVERY_LAG_TIME
89
No
USER PERFORMS OTHER ADMIN. FUNCTION(S)
91

FIG. 3

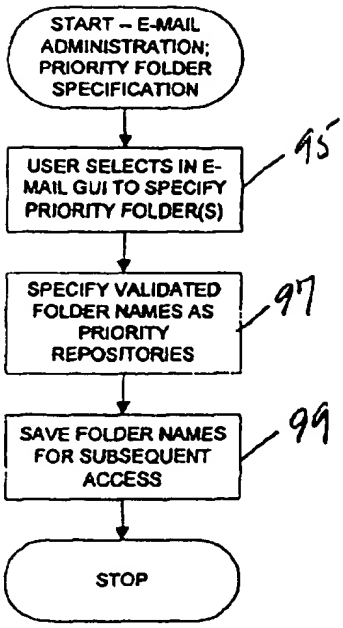


FIG. 4

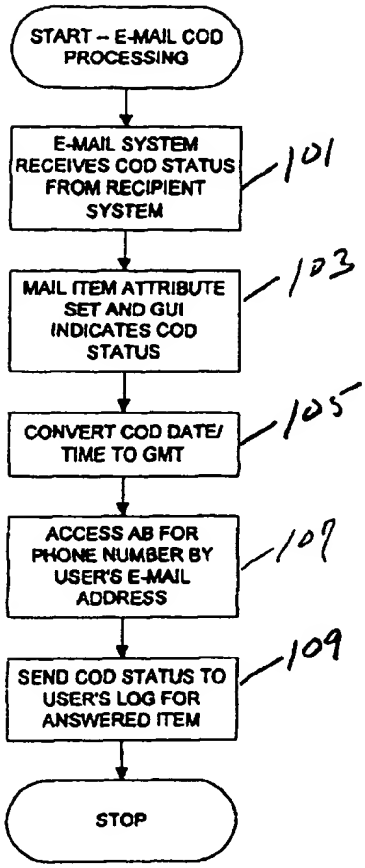


FIG. 5

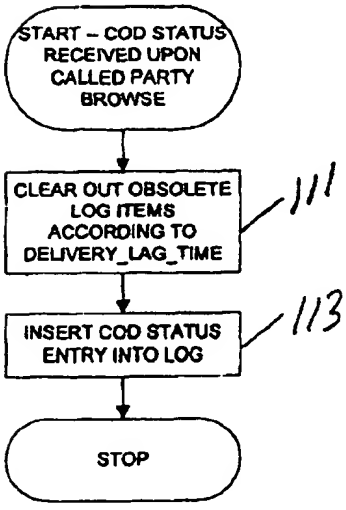


FIG. 6

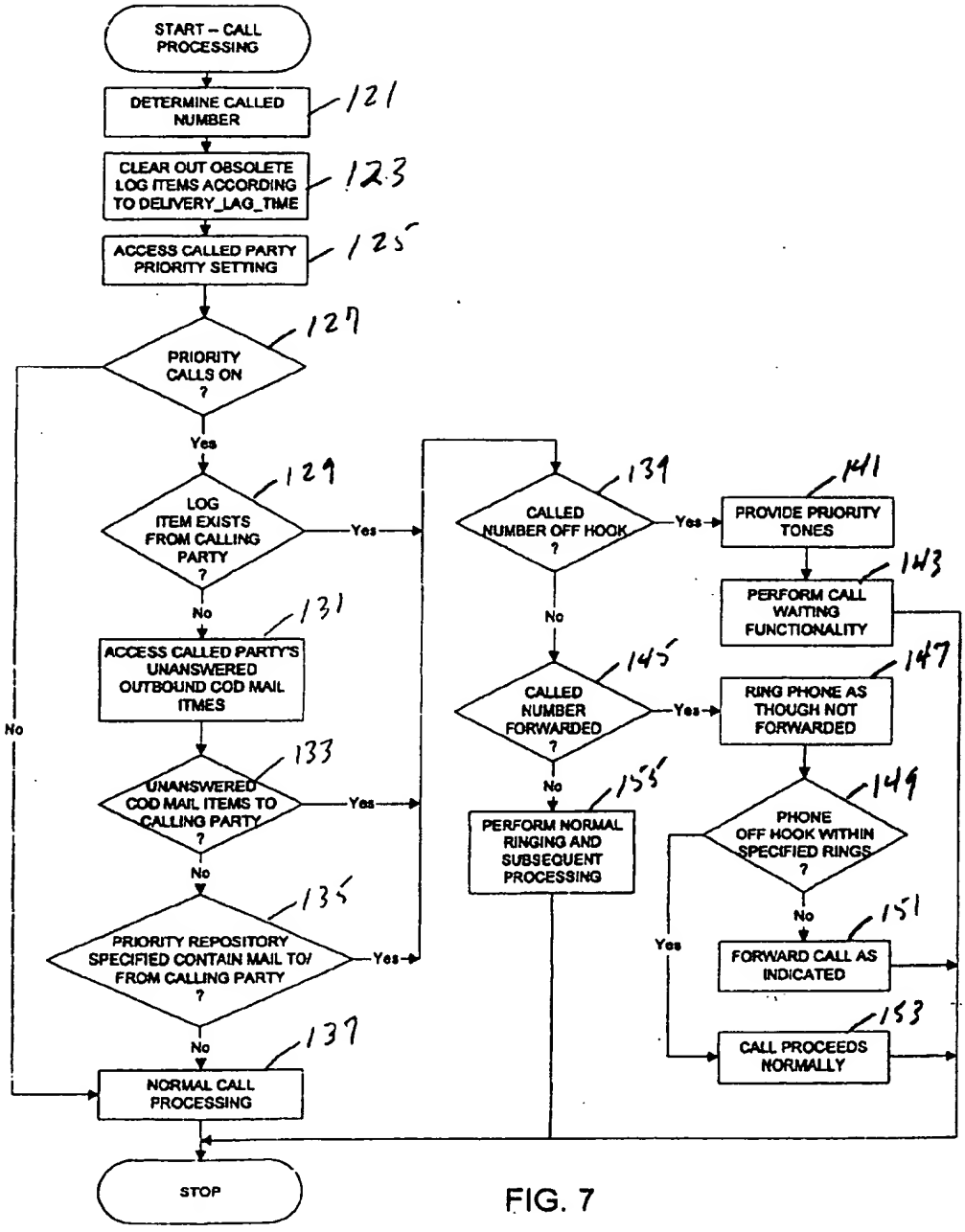

START – CALL PROCESSING
DETERMINE CALLED NUMBER
121
CLEAR OUT OBSOLETE LOG ITEMS ACCORDING TO DELIVERY_LAG_TIME
123
ACCESS CALLED PARTY PRIORITY SETTING
125
PRIORITY CALLS ON ?
127
Yes
No
LOG ITEM EXISTS FROM CALLING PARTY ?
129
Yes
No
ACCESS CALLED PARTY'S UNANSWERED OUTBOUND COD MAIL ITMES
131
UNANSWERED COD MAIL ITEMS TO CALLING PARTY ?
133
Yes
No
PRIORITY REPOSITORY SPECIFIED CONTAIN MAIL TO/ FROM CALLING PARTY ?
135
Yes
No
NORMAL CALL PROCESSING
137
CALLED NUMBER OFF HOOK ?
139
Yes
No
PROVIDE PRIORITY TONES
141
PERFORM CALL WAITING FUNCTIONALITY
143
CALLED NUMBER FORWARDED ?
145
Yes
No
RING PHONE AS THOUGH NOT FORWARDED
147
PERFORM NORMAL RINGING AND SUBSEQUENT PROCESSING
155
PHONE OFF HOOK WITHIN SPECIFIED RINGS ?
149
Yes
No
FORWARD CALL AS INDICATED
151
CALL PROCEEDS NORMALLY
153
STOP

FIG. 7

METHOD OF AND SYSTEM FOR PRIORITY CALL PROCESSING BASED UPON ELECTRONIC MAIL STATUS

BACKGROUND

The present invention relates generally to the field of telephone and electronic mail system integration, and more particularly to a method of and system for providing priority call processing based upon electronic mail status between a calling party and a called party.

Current telephone systems, implemented in circuit switched environments, such as the public switched telephone network (PSTN) or private branch exchange (PBX) networks, or in packet switched environments, such Internet protocol (IP) telephony systems, provide many options for enhancing the usefulness of the system to users. For example, voice mail enables users to have their calls answered by an automated system that records a voice message from the calling party if the called party is unavailable or desires not to take the call. Call forwarding allows a user to have calls to their number forwarded to another number. Call forwarding can be combined with voice mail so that a user can have calls forwarded automatically to voice mail. Certain telephone devices include a do not disturb (DND) key that is used to automatically forward calls to voice mail, a secretary, or a message center.

Voice mail and call forwarding thus enable a user not to be disturbed during meetings or during periods when the user wishes to work without being interrupted with telephone calls. However, there are times that a user would like to receive certain priority calls at the same time the user wishes not to be bothered with normal calls. For example, a user may have sent a priority or urgent electronic mail item to a party and expect a call from that party regarding the electronic mail item. In such case, the user might wish not to receive most calls, but the user would certainly want to speak immediately to the recipient of the electronic mail item. Currently, the user must either receive all calls, or monitor his or her voice mail box for messages from the recipient of the electronic mail item. If a caller ID display is available the calling party must call from a recognized phone and the called party must be able to recognize the caller ID.

SUMMARY

The present invention provides a method of and system for providing priority call processing based upon the status of electronic mail items between a called party and a calling party. The present invention may be implemented in a circuit switched telephone network, such as the public switched telephone network (PSTN) or a private branch exchange (PBX) network, or in a packet switched network, such as an Internet telephony system. Suitable application programming interfaces (APIs) are provided between the telephone system elements and an electronic mail system.

When the system of the present invention receives a request to set up a call between the calling party and the called party, the system determines if the called party has priority call processing activated or enabled. If not, the system provides normal call processing. However, if priority call processing is enabled or activated, the system determines if there is a priority electronic mail item between the called party and the calling party. If so, the system provides special processing of the call.

An example of a priority electronic mail item is an electronic mail item to or from the calling party that the called party has designated a priority item, as for example by placing the electronic mail item in a priority electronic mail repository. Another example of a priority electronic mail item is an item that is inherently of a priority nature, such as a confirm on delivery (COD) electronic mail item. For example, a call will receive priority processing according to the present invention if the called party has sent an unanswered COD electronic mail item to the calling party. A call will also receive priority processing according to the present invention if the called party has sent a COD electronic mail item to the calling party within a predetermined time prior to receiving the call.

Priority call processing according to the present invention includes such processing as providing special call waiting and overriding call forwarding. Special call waiting according to the present invention includes determining if the called party number is busy, waiting the priority call, and providing a special priority call waiting announcement or tone to the called party. If the called party number is forwarded to another number, such to voice mail, a do not disturb number, or simply another number, priority call processing according to the present invention rings the called party number in an appropriate manner based upon the status (e.g., a pre-selected number of times), to allow the called party to answer, and then forwards the call to the call forwarding number.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a circuit switched network according to the present invention.

FIG. **2** is a block diagram of a packet switched network according to the present invention.

FIG. **3** is a flowchart of voice mail administration processing according to the present invention.

FIG. **4** is a flowchart of electronic mail administration with priority folder specification processing according to the present invention.

FIG. **5** is a flowchart of electronic mail confirm on delivery (COD) processing according to the present invention.

FIG. **6** is a flowchart of COD status processing according to the present invention.

FIG. **7** is a flowchart of call processing according to the present invention.

DETAILED DESCRIPTION

Referring now to the drawings, and first to FIG. **1**, a circuit switched embodiment of the present invention is designated generally by the numeral **11**. System **11** is implemented in a private telephone network that accesses the public switched telephone network (PSTN) **13** through a private branch exchange (PBX) switch **15**.

System **11** includes a plurality of telephone devices, including a calling party telephone **17** and a called party telephone **19**, connected to PBX **15**. Calling party telephone **17** and called party telephone **19** are each associated with a respective user identified by a telephone number or extension. According to the present invention, each user is also associated with a personal computer. Thus, user of calling party telephone **17** is associated with a calling party personal computer **21**. Similarly, user of called party telephone **19** is associated with a called party personal computer **23**. Personal computers **21** and **23** for each identified by a network address and an electronic mail address associated with their respective users. According to the present invention, tele-

phones 17 and 19 are interface to personal computers 21 and 23, respectively, by a suitable communications interface, such as an M-WAVE™ or ROLM244 PC™ interface, in a manner well known to those skilled in the art.

The telephone portion of system 11 includes a voice mail platform 25 interfaced to PBX 15, in the manner well known to those skilled in the art. Voice mail platform 25 cooperates with PBX 15 to provide standard voice mail services as well as enhanced integrated telephone and electronic mail service according to the present invention. Voice mail platform 25 includes an administrative interface that is preferably implemented in a voice response unit that enables users to administer their voice mail boxes in the manner well known to those skilled in the art. As will be explained in detail hereinafter, the administrative interface of voice mail platform 25 enables users of system 11 to administer call processing according to the present invention.

Personal computers 21 and 23 operate in local area network (LAN) environment 27. LAN 27 is preferably interfaced to a wide area network or to the Internet (neither shown). LAN 27 includes an electronic mail server 29 and an address book server 31. Electronic mail server 29 and address book server 31 provide standard electronic mail and address book services, respectively. Electronic mail server 29 and address book server 31 also provide services according to present invention PBX 15 through suitable application programming interfaces (APIs), as will be explained detail hereinafter.

Referring now to FIG. 2, the present invention also operates in a packet switched telephone system such as an Internet protocol (IP) telephone network 41. In network 41, calls are set up using a signaling protocol such as session initiation protocol (SIP) or H.323 protocol. After setup, calls are transported across Internet 43 using a protocol such as real-time transport protocol (RTP), or the like. Calls can be made between calling parties and called parties across Internet 43 using Web phone enabled personal computers, such as personal computers 45 and 47, and Internet phone devices, such as IP phone 49. A call manager 51, which in the preferred embodiment includes a SIP proxy server, provides services such as local number portability, call forwarding, quality of service, and other services during call setup. Network 41 is interfaced to public switched telephone networks 53 and 55 through IP telephony gateways 57 and 59, respectively. Thus, calls can be made between IP telephony users and PSTN users.

In network 41, such services as voice mail, electronic mail, and address book are provided by applications that reside on servers or personal computers. Voice mail, electronic mail, and address book applications may be implemented in a shared client-server environment, or they may be implemented as stand-alone applications on an individual personal computer. In any event, and as will be apparent to the skilled in the art, suitable APIs are provided according to present invention to integrate the voice mail, electronic mail, and address book functions.

Referring now to FIG. 3, there is shown a flowchart of voice mail administration processing according to one embodiment of the present invention. The embodiment of FIG. 3 finds particular application in the circuit switched environment of FIG. 1 or alternatively, in the environment of FIG. 2. The administration interface of the voice mail system provides a user interface by which the user can interact with the system of the present invention. In FIG. 3, the user connects to the administration interface by telephone, as indicated at block 71. In one embodiment, the user connects to the administration interface by dialing a particular number or extension. The administration interface includes a voice response unit that guides the user through audio menus.

After the user has connected to the administration interface, the system tests, at decision block 73, if the current session is the user's first visit to the administrative interface. If so, the system sets a default delivery lag time, at block 75. The system of the present invention treats, as priority, recently delivered electronic mail items. According to the present invention, items delivered within the delivery lag time prior to the time that a particular call is initiated are considered recently delivered and deemed to be priority mail items.

If, at decision block 73, the user has previously visited the administration interface, the user navigates through the interface, as indicated generally at block 77. During navigation, the user is presented with prompts that are mapped to menu items. Typically, a user can exit or quit the administration interface by entering a particular DTMF signal or by hanging up. If, at decision block 79, the user selected to quit, the administrative interface is terminated, at block 81, and FIG. 3 processing ends. If, at decision block 83, it is determined the user entered a DTMF signal indicating the user's desire to modify priority handling, the user is prompted to specify ON or OFF for priority call handling, at block 85. As will be explained in detail hereinafter, if the user specifies ON for priority calls, then calls will receive priority processing according to present invention. If the user specifies OFF, then calls will be processed normally. If, at decision block 87, it is determined that the user entered a DTMF signal indicating the user's desire to modify delivery lag time, the system prompts the user to enter a delivery lag time, at block 89. For example, the user may be prompted to enter digits corresponding to a number of days and/or hours. As indicated at block 91, the user may perform other administration functions that are typical in currently existing voice mail systems. FIG. 3 processing continues until the user quits, as determined at decision block 79. In an alternative embodiment, an IP phone may be used in a similar fashion to accomplish FIG. 3 administration. In another embodiment, a personal computer equipped with telephone-like functionality may be used to accomplish FIG. 3 administration.

Referring now to FIG. 4, there is shown a flowchart of electronic mail administration and priority folder specification according to present invention. In addition to recently delivered electronic mail items, the system of the present invention treats, as priority, electronic mail items that a user has placed in a priority repository or folder. In FIG. 4 processing, the user selects in an electronic mail graphical user interface (GUI) to specify priority folders, at block 95. Graphical user interfaces and their implementations are generally well-known to those skilled in the art. During priority folder specification, the user is prompted to specify one or more validated folder names as priority repositories, at block 97. The system then saves the folder name or names for subsequent access, at block 99. In addition to electronic mail items placed in a priority folder, confirm on delivery (COD) electronic mail items are deemed to be of a priority nature. COD electronic mail items are those for which the sending party has requested confirmation of delivery. Confirmation of delivery is typically reserved for electronic mail items that the sending party deems to be particularly important. Referring to FIG. 5, there is shown electronic mail confirmation of delivery processing according to the present invention. The electronic mail system receives confirmation on delivery status from a recipient electronic mail system, at

block **101**. A COD attribute is set for the mail item and the user's electronic mail graphical user interface indicates COD status, at block **13**. Then, the system converts the COD date and time to Greenwich mean time (GMT), at block **105**. After converting to GMT, the system uses the recipient's electronic mail address to access the address book for the recipient's telephone number, at block **107**. According to the present invention, the PBX maintains a log for each user of COD status. At block **109**, electronic mail system sends COD status for the answered item to the user's log, and FIG. **4** processing ends.

Referring now to FIG. **6**, there is shown a flowchart of COD status maintenance that is performed when a user browses his or her electronic mail. When the user browses his or her electronic mail, the system clears out obsolete log items according to delivery lag time, at block **111**. Thus, the system deletes from the log COD items delivered earlier than the delivery lag time. Then, the system inserts a COD status entry into the log, at block **113** for a COD marked item that the user browses.

Referring now to FIG. **7**, there is shown a flowchart of call processing according to the present invention. FIG. **5** processing may be performed in connection with a terminating switch or terminating PBX, in a circuit switched telephony environment, or a terminating personal computer in an IP telephony environment. When a call is received, the terminating switch, PBX, or personal computer determines the called number, at block **121**. According to the present invention, the system clears out obsolete log items according to the delivery lag time, at block **123**. Then, the system accesses the call party's priority setting, at block **125**. It will be recalled that the priority setting is either ON or OFF. If, at decision block **127**, the priority setting is ON, the system tests, at decision block **129**, if a log item exists from the calling party. The calling party's identity is determined by the caller ID number received with the call. If a log item exists from the calling party, then the system performs priority processing as described hereinafter.

If, at decision block **129**, a log item does not exist from the calling party, then the system accesses the called party's unanswered outbound COD mail items, at block **131**. Then, the system tests, at decision block **133**, if there are any unanswered COD electronic mail items from the called party to the calling party. If so, the system performs priority call processing. If, at decision block **133**, there are no unanswered COD items, then the system accesses the called party's priority repository or repositories and tests, at decision block **135**, if the repository contains any electronic mail items to or from the calling party. If so, the system performs priority call processing. If not, the system performs normal call processing, as indicated generally at block **137**.

During priority call processing, the system tests, at decision block **139**, if the called number is off hook or busy. If so, the system provides priority tones, at block **141**, and performs call waiting functionality, at block **143**. Priority tones comprise a signal or announcement to the called party that a priority call is waiting. The system performs call waiting functionality so that the called party can answer the priority call.

If, at decision block **139**, the called number is on hook, the system tests, at decision block **145**, if the called number is forwarded. If so, the system overrides call forwarding by ringing the called number as though the number were not forwarded, at block **147**. Typically, a user invokes call forwarding either to avoid receiving non-priority calls or to receive calls at another location. Since it is not known what motivated the called party to invoke call forwarding, the system rings the called number only a specified limited number of times. If, at decision block **149**, the phone does not go off hook within the specified number of rings, the system forwards the call as indicated, at block **151**. If the called party answers the call within the specified number of rings, the call proceeds normally, as indicated at block **153**. Referring back to decision block **145**, if the called number is not forwarded, then the system performs normal ringing and subsequent processing, as indicated at block **155**.

From the foregoing, it may be seen that the present invention is well adapted to overcome the shortcomings of the prior art. The present invention provides greater flexibility in allowing a user to receive priority calls while using features, such as voice mail and call forwarding, to avoid answering non-priority calls, and while he or she is on a call to another party. The present invention is applicable to both circuit switched telephone systems and packet switched telephone systems.

What is claimed is:

1. A method of processing a call, which comprises the steps of:

receiving a request to set up a call between a calling party and, a called party; determining if said called party has a call priority setting on; and,

if said called party has said priority setting on, providing special processing of said call based upon electronic mail status between said calling party and, said called party, wherein said electronic mail status between said calling party and said called party includes the existence of an electronic mail item between said calling party and said called party in a priority repository of said called party.

2. The method as claimed in claim **1**, wherein said electronic mail status between said calling party and, said called party includes the existence of a priority electronic mail item between said called party and, said calling party.

3. The method as claimed in claim **2**, wherein said priority electronic mail item is a confirm on delivery mail item from said called party to said calling party.

4. The method as claimed in claim **2**, wherein said priority electronic mail item is a confirm on delivery mail item from said called party to said calling party delivered within a set time period prior to receipt of said request to set up said call.

5. The method as claimed in claim **4**, wherein said time period is set by said called party.

6. The method as claimed in claim **2**, wherein said priority mail item is an unanswered confirm on delivery electronic mail item from said called party to said calling party.

7. The method as claimed in claim **1**, wherein said step of providing special processing of said call based upon electronic mail status between said calling party and, said called party includes the step of:

waiting said call if said called party telephone device is busy.

8. The method as claimed in claim **7**,including the step of:

providing a special notification to said calling party that a priority call is waiting.

9. The method as claimed in claim **1**, including the step of:

overriding call forwarding.

10. The method as claimed in claim **9**, wherein said step of overriding call forwarding includes the step of:

ringing the number of said called party if said called number is forwarded to a second number.

11. The method as claimed in claim 10, including the step of:

forwarding said call to said second number if the telephone device associated with said called party number is not answered within a selected number of rings.

12. The method as claimed in claim 10, wherein said ringing includes the step of: providing a special priority ringing tone.

13. A priority call processing system, which comprises:

an electronic mail system for transferring electronic mail items between a calling party and a called party;

a telephone system for setting up calls between said calling party and said called party; and,

intelligence for providing priority call processing of a call from said calling party to said called party based upon the status of electronic mail items delivered between said called party and said calling party.

14. The system as claimed in claim 13, wherein said telephone system includes a circuit switched telephone system.

15. The system as claimed in claim 13, wherein said telephone system includes a packet switched telephone system.

16. The system as claimed in claim 15, wherein said packet switched telephone system includes an Internet telephony system.

17. A method of processing a call, which comprises the steps of:

receiving a request to set up a call between a calling party and a called party;

determining if said called party has a call priority setting set to on;

if said called party has said call priority setting set to on, determining status of electronic mail between said called party and said calling party; and,

processing said call based upon said status.

18. The method as claimed in claim 17, wherein said step of determining said status includes the step of:

determining if there exists an unanswered confirm on delivery electronic mail from said called party to said calling party.

19. The method as claimed in claim 17, wherein said step of determining said status includes the step of:

determining if there exists an unanswered confirm on delivery electronic mail delivered from said called party to said calling party within a particular delivery lag time prior to receipt of said call.

20. The method as claimed in claim 17, wherein said step of determining said status includes the step of:

determining if there exists an answered confirm on delivery electronic mail from said called party to said calling party.

21. The method as claimed in claim 17, wherein said step of determining said status includes the step of:

determining if there exists an electronic mail between said called party and, said calling party in a priority repository of said called party.

22. The method as claimed in claim 17, wherein said step of processing said call includes the step of:

providing priority processing to said call if said status indicates a priority electronic mail item between said calling party and said called party.

23. The method as claimed in claim 22, wherein said step of providing priority processing includes the step of:

determining if the telephone device associated with said called party is busy.

24. The method as claimed in claim 23, including the step of:

providing priority call waiting if said telephone device is busy.

25. The method as claimed in claim 23, including the step of:

if said telephone device is not busy, determining if said the number of said called party is forwarded.

26. The method as claimed in claim 25, including the step of:

if said number is forwarded, ringing said number as though not forwarded.

27. The method as claimed in claim 26, including the step of:

forwarding said call if said number is not answered within a particular number of rings.

28. A method of processing a call, the method comprising:

specifying by a first user priority handling of the call, wherein the first user transmits an electronic mail message to a second user to request placement of the call to the first user by the second user;

determining whether the electronic mail message is a priority mail item based upon a delivery lag time corresponding to time of delivery of the electronic mail message to the second user; and

selectively providing priority handling of the call based upon the specification by the first user and the determination that the electronic mail message is a priority mail item.

* * * * *

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United States Patent [19]

Ahlberg et al.

[11] Patent Number: 5,600,704

[45] Date of Patent: Feb. 4, 1997

[54] **SYSTEMS AND METHODS FOR PRIORITIZED ROUTING OF TELEPHONE CALLS TO A SUBSCRIBER**

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[73] Assignee: **Ericsson Inc.**, Research Triangle Park, N.C.

[21] Appl. No.: **298,406**

[22] Filed: **Aug. 30, 1994**

[51] **Int. Cl.**[6] **H04M 3/42**; H04M 11/00

[52] **U.S. Cl.** **379/58**; 379/201; 379/211

[58] **Field of Search** 379/200, 210, 379/211, 57, 58, 59, 60, 61, 62, 63, 201

[56] **References Cited**

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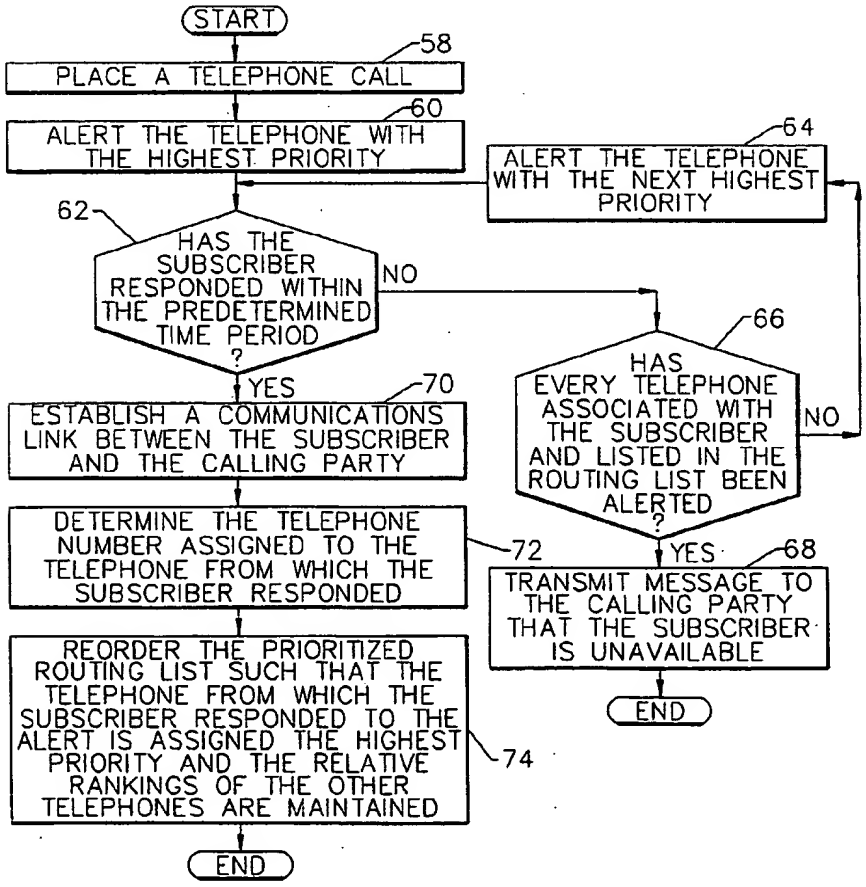
Primary Examiner—Curtis Kuntz
Assistant Examiner—Nay Aung Maung
Attorney, Agent, or Firm—Bell, Seltzer, Park & Gibson

[57] **ABSTRACT**

A cellular radio communications system maintains a prioritized routing list of several telephone numbers associated with a predetermined subscriber for efficiently establishing a communications link between a calling party and the subscriber. The telephone numbers of the several telephones associated with the subscriber are initially assigned relative priorities such that the telephones are sequentially alerted according to the prioritized routing lists of telephone numbers when a telephone call is placed to the subscriber. The prioritized routing list is subsequently reordered such that the telephone number from which the telephone from which the subscriber responded to the prior alert is assigned the highest priority will be initially alerted in response to the next telephone call placed to the subscriber.

31 Claims, 2 Drawing Sheets



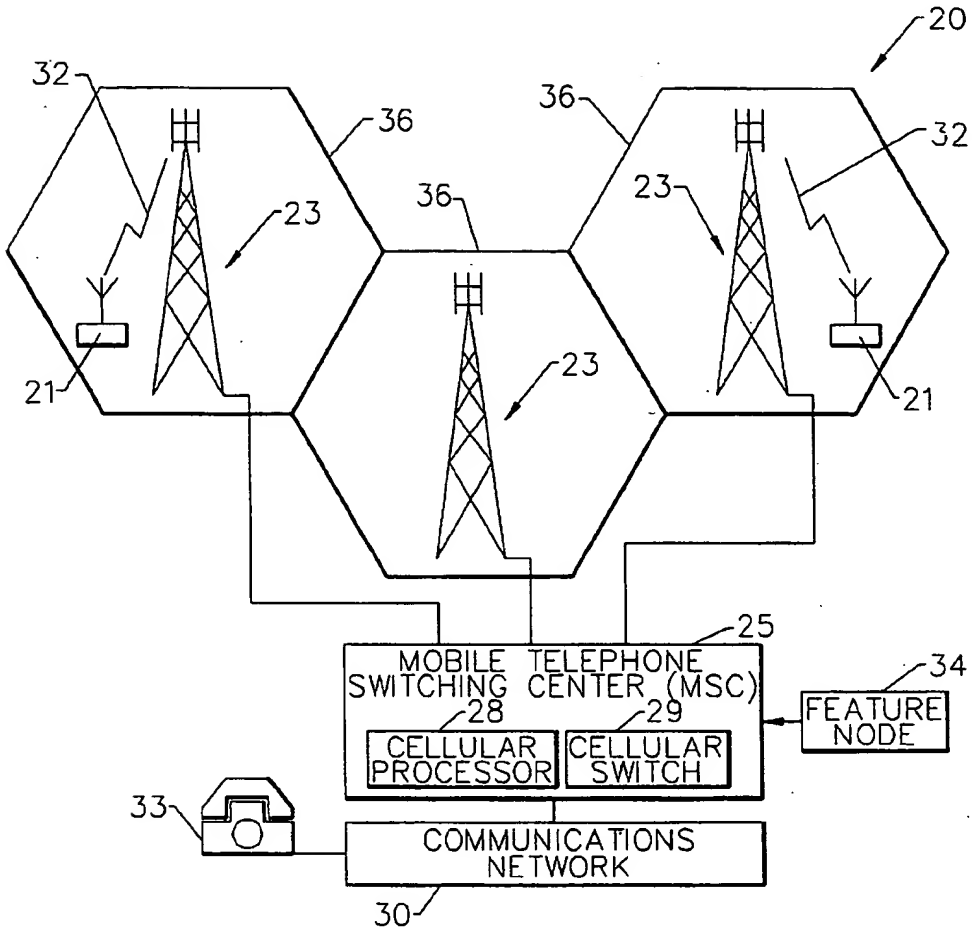


FIG. 1.

38

10	CELLULAR TELEPHONE
7	WORK TELEPHONE
⋮	
1	HOME TELEPHONE

FIG. 2A.

39

10	WORK TELEPHONE 1
10	WORK TELEPHONE 2
8	CELLULAR TELEPHONE
6	WORK TELEPHONE 3
⋮	
1	HOME TELEPHONE

FIG. 2B.

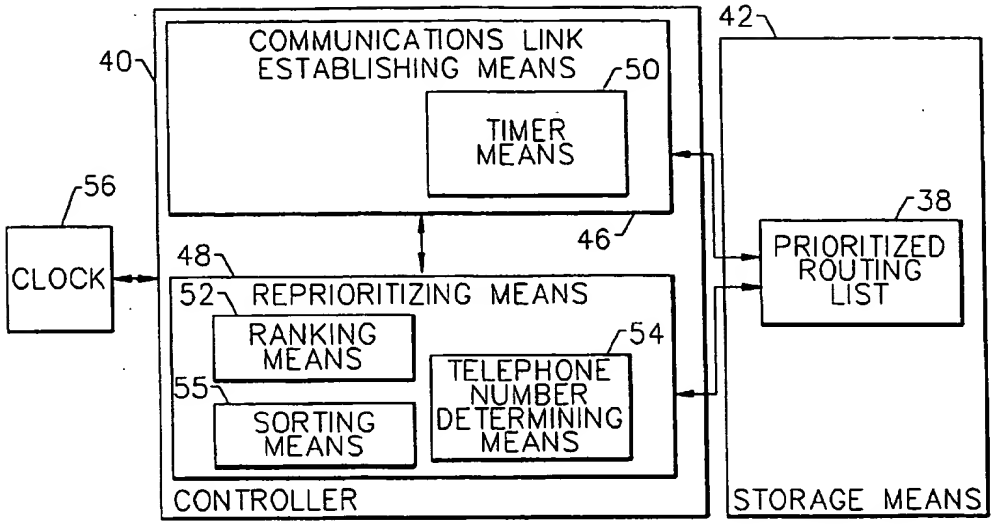

COMMUNICATIONS LINK ESTABLISHING MEANS
50
TIMER MEANS
40
42
56
CLOCK
48
52
REPRIORITIZING MEANS
RANKING MEANS
54
TELEPHONE NUMBER DETERMINING MEANS
55
SORTING MEANS
46
38
PRIORITIZED ROUTING LIST
CONTROLLER
STORAGE MEANS

FIG. 3.

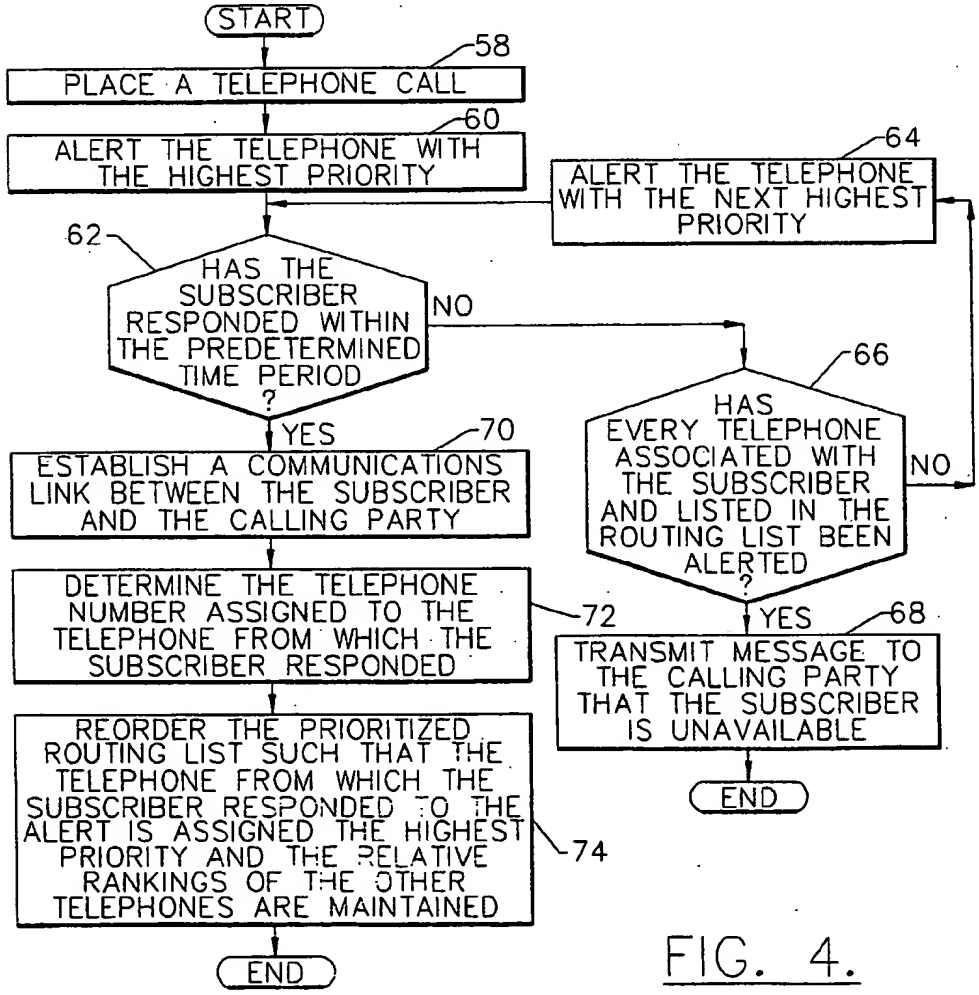

START
58
PLACE A TELEPHONE CALL
60
ALERT THE TELEPHONE WITH THE HIGHEST PRIORITY
64
ALERT THE TELEPHONE WITH THE NEXT HIGHEST PRIORITY
62
HAS THE SUBSCRIBER RESPONDED WITHIN THE PREDETERMINED TIME PERIOD ?
NO
YES
66
HAS EVERY TELEPHONE ASSOCIATED WITH THE SUBSCRIBER AND LISTED IN THE ROUTING LIST BEEN ALERTED ?
NO
YES
70
ESTABLISH A COMMUNICATIONS LINK BETWEEN THE SUBSCRIBER AND THE CALLING PARTY
DETERMINE THE TELEPHONE NUMBER ASSIGNED TO THE TELEPHONE FROM WHICH THE SUBSCRIBER RESPONDED
72
68
TRANSMIT MESSAGE TO THE CALLING PARTY THAT THE SUBSCRIBER IS UNAVAILABLE
REORDER THE PRIORITIZED ROUTING LIST SUCH THAT THE TELEPHONE FROM WHICH THE SUBSCRIBER RESPONDED TO THE ALERT IS ASSIGNED THE HIGHEST PRIORITY AND THE RELATIVE RANKINGS OF THE OTHER TELEPHONES ARE MAINTAINED
74
END
END

FIG. 4.

SYSTEMS AND METHODS FOR PRIORITIZED ROUTING OF TELEPHONE CALLS TO A SUBSCRIBER

FIELD OF THE INVENTION

The present invention relates generally to cellular radio communications systems and methods and, more particularly, to systems and methods for efficiently establishing communications in a cellular radio communications system.

BACKGROUND OF THE INVENTION

Cellular radio communications systems are increasingly employed to provide wireless voice and data communications to a number of mobile units or subscribers. Cellular radio communications systems include both analog cellular systems, such as the "AMPS" system, and, more recently, digital cellular systems, such as the pan-European "GSM" system. These systems, and others, are described in a book entitled *Dual Mode Cellular* by Harte, published by P. T. Steiner Publishing Co., Bridgeville, Pa. (1992).

A cellular radio communications system generally includes one or more cellular telephones, one or more radio base stations and a Mobile Telephone Switching Center (MSC). A typical cellular radio communications system can include hundreds of radio base stations, thousands of cellular telephones and one or more MSC's. A cellular radio communications system includes a number of spaced apart radio zones referred to as cells. Each cell includes a radio base station for transmitting and receiving messages to and from cellular telephones which are located within the cell range.

Each cell of the cellular radio communications system typically includes a plurality of duplex voice channels over which cellular telephone messages are carried. Each cell is also provided with a number of control channels to control the operation of the cellular telephones and the assigned voice channels. Accordingly, through the cellular radio communications system, a duplex radio communication signal or link can be established between two cellular telephones or, between the cellular telephone and the wire line telephone.

As used herein, the term "cellular telephone" encompasses a wide variety of portable telephone devices which access a cellular radio communications system. Cellular telephones include mobile telephones that are hand held or of a bag phone variety and permanently mounted car cellular telephones. The term "cellular telephone" also include terminals which provide functions in addition to those of a cellular telephone, such as facsimile, data communications, data processing, word processing applications and other personal communication systems functions. These highly functional cellular telephones are often referred to as "Personal Communication Systems."

Each radio base station generally includes a control unit and an associated antenna. With respect to the cellular telephones located within the cell range, the base station functions chiefly to relay messages to and from the cellular telephones. The radio base station also supervises the quality of the communications link with the cellular telephones. A typical radio base station is Model No. RBS882 manufactured by Ericsson Telecom AB Stockholm, Sweden for the CMS8800 cellular mobile telephone system. A full description of this analog cellular network is provided in Publication No. EN/LZT 101 908 R2B, published by Ericsson Telecom AB.

A number of base stations are connected to a single MSC which acts as the central coordinating element of the cellular system. The MSC includes a cellular processor and a cellular switch connected to the Public Switched Telephone Network (PSTN) to allow communications between the cellular telephones and wire line telephones. The MSC can also be associated with a Home Location Register (HLR). The HLR includes storage means for storing data relating to the subscribers of the cellular system. This data can include the telephone number of the subscriber as well as any specific services requested by the subscriber, such as call waiting or call hold. The HLR can also include processing means for manipulating the stored subscriber data.

A feature node can also be associated with the MSC of a cellular radio communications system or with another associated communications network, such as the PSTN. For example, the feature node can be incorporated within or associated with the HLR. Even if the feature node is associated with another communications network, such as the PSTN, the cellular radio communications network can access the feature node via the interconnection between the MSC of the cellular radio communications system and the PSTN or other communications network.

A feature node provides predetermined functions to the cellular telephones or the telephones associated with the PSTN, such as, for example, establishing an efficient communications link between telephones, such as via intermediate radio base stations, or providing voice-controlled speech information and number translation services as well as facilitating the establishment of conference telephone calls. Still further, a feature node can provide paging services for the user of a cellular telephone and can facilitate the establishment of alternative communications links if the primary communications link is unavailable. A feature node is described, for example, in more detail in U.S. patent application Ser. No. 018,268 entitled "A Method Of Establishing Cooperation With A Functionality" and U.S. patent Application Ser. No. 018,223 entitled "A Method Of Organizing Communication", both of which were filed on Feb. 16, 1993 and both of which are incorporated herein by reference.

Numerous subscribers or users of a cellular radio communications system have more than one telephone, each of which is typically assigned a different telephone number. For example, cellular radio communications system subscribers typically have a telephone at their place of business (hereinafter referred to as a "work telephone"), a telephone at their residence (hereinafter referred to as a "home telephone") and a cellular telephone. In order to provide parties with the best opportunity to contact the subscriber, the subscriber must generally provide the calling party with the telephone number assigned to each of the different telephones associated with the subscriber. For a subscriber having several telephones, it is undesirable to provide another party with each of the telephone numbers due to the sizeable amount of information which must be accurately exchanged between the subscriber and the calling party. Further, the calling party must record and retain not just one telephone number, but several telephone numbers associated with the subscriber.

Even if each telephone number associated with the subscriber is accurately provided to and recorded by the calling party, the calling party can generally only place a telephone call to the telephone number assigned to one of the subscriber's telephones at a time. Thus, the calling party typically places an initial call to the telephone at which the calling party believes the subscriber is most likely to

respond. If the subscriber does not respond to the alert of the telephone which was initially called, the calling party must subsequently try one or more of the remaining telephone numbers assigned to other telephones associated with the subscriber. Accordingly, the calling party must typically place several different telephone calls, each of which require the entry of a different telephone number, in an attempt to reach the subscriber. This process of placing a telephone call to a subscriber is thus not only laborious for the calling party, but is also prone to errors in the recordation and entry of the telephone numbers.

Each telephone call placed to or from a cellular telephone increases the load on the cellular radio communications system with which the cellular telephone is associated. Based upon the components of cellular radio communications system, each system typically has a predetermined maximum allowable load which it is adapted to efficiently accommodate. The operators of the cellular radio communications system, however, do not generally charge a fee for unanswered telephone calls even though such calls increase the system's load. Therefore, the multiple telephone calls which can be placed in an attempt to reach a subscriber who is associated with a plurality of telephones increase the load of the cellular radio communications system without allowing the operator of the cellular radio communications network to charge a fee. Thus, there is a need to provide methods and systems to allow a calling party to efficiently place a call to a subscriber of a cellular radio communications system who is associated with several telephones, each of which has a different telephone number.

SUMMARY OF THE INVENTION

In view of the foregoing background, it is therefore an object of the present invention to provide improved cellular radio communications systems and methods.

It is also an object of the present invention to provide cellular radio communications systems and methods which efficiently route telephone calls to a subscriber.

These and other objects are provided, according to the present invention, by cellular radio communications systems and methods which maintain and sort a prioritized routing list of a plurality of telephone numbers, each of which is assigned to a telephone associated with a predetermined subscriber of a cellular radio communications system, such that telephone calls can efficiently be placed to the predetermined subscriber.

A cellular radio communications system according to the present invention includes a prioritized routing list of the plurality of telephone numbers assigned to the telephones of the predetermined subscriber of the cellular radio communications system. The cellular radio communications system also includes communications link establishing means, responsive to the prioritized routing list, for establishing a communications link between a source telephone placing a telephone call and a telephone associated with the subscriber. The communications link establishing means sequentially alerts the telephones associated with the subscriber according to the prioritized routing list of telephone numbers associated with the subscriber.

Further, the cellular radio communications system of the present invention includes reprioritizing means, responsive to the communications link establishing means, for sorting the prioritized routing list of telephone numbers associated with the subscriber. In particular, the prioritized routing list is sorted such that the telephone from which the subscriber responded to the alert is assigned the highest priority and, accordingly, will be initially alerted by the communications link establishing means in response to the next telephone call placed to a telephone associated with the subscriber.

The prioritized routing list generally includes a listing of telephone numbers ranked from a highest priority to a lowest priority. Consequently, the reprioritizing means typically includes ranking means for designating the telephone number assigned to the telephone from which the subscriber responded to the alert with the highest priority of the prioritized routing list. The ranking means also maintains the relative rankings of the telephone numbers assigned to the other telephones associated with the subscriber from which the subscriber did not respond to the alert. The reprioritizing means can also include telephone number determining means for determining the telephone number assigned to the telephone from which the subscriber responded to the alert.

In one embodiment, the reprioritizing means also includes means for sorting the prioritized routing list of telephone numbers associated with the predetermined subscriber after the subscriber places a telephone call from an associated telephone such that the telephone from which the subscriber placed the telephone call is assigned the highest priority and is initially alerted by said communications link establishing means in response to a next telephone call placed to the predetermined telephone number associated with the subscriber.

The communications link establishing means also generally includes timer means for determining if the subscriber has responded to an alert of a first telephone within a predetermined time period. If the subscriber has not responded to the alert of the first telephone within the predetermined time period, the communications link establishing means can alert a second telephone associated with the subscriber according to the prioritized routing list.

A cellular radio communications system of the present invention can also include a cellular radio network associated with the prioritized routing list, the communications link establishing means and the reprioritizing means. The cellular radio communications system can also include a plurality of cellular telephones responsive to the cellular radio network.

In one embodiment, the cellular radio communications system includes a mobile telephone switching office, responsive to the cellular radio network, for processing and storing data related to the subscribers of the cellular radio network. In this embodiment, the mobile telephone switching office includes the prioritized routing list, the communications link establishing means and the reprioritizing means. In another embodiment, the cellular radio communications system also includes a feature node, responsive to the cellular radio network, for providing predetermined functions to the plurality of cellular telephones. In this embodiment, the feature node includes the prioritized routing list, the communications link establishing means and the reprioritizing means.

Thus, the cellular radio communications systems and methods of the present invention allows telephone calls to be placed to a telephone associated with a predetermined subscriber in an efficient manner. More specifically, the cellular radio communications systems and methods of the present invention sorts the prioritized routing list of telephone numbers associated with the predetermined subscriber following each telephone call to which the subscriber responds. Thus, the telephone from which the subscriber most recently responded will be initially alerted by the next telephone call placed to a telephone associated with the

subscriber. The cellular radio communications systems and methods of the present invention therefore increases the efficiency with which telephone calls are routed since only one telephone number need be provided and entered and since the likelihood that the subscriber will respond to the alert of the first telephone is increased, thereby decreasing the time and effort required to establish a communications link.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram illustrating the basic components of a cellular radio communications system.

FIGS. **2A** and **2B** are block diagrams of two embodiments of a prioritized routing list according to the present invention.

FIG. **3** is a schematic block diagram of controller and associated storage means incorporating the present invention.

FIG. **4** illustrates detailed operations for maintaining and sorting a prioritized routing list of telephone numbers assigned to telephones associated with a predetermined subscriber according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which a preferred embodiment of the invention is shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, this embodiment is provided so that this disclosure will be thorough and complete and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

Referring now to FIG. **1**, a cellular radio communications system **20** is illustrated. The cellular radio communications system **20** includes a plurality of regions or cells **36**, each of which is defined by a corresponding radio base station **23**. Each radio base station **23** of the cellular radio communications system **20** is connected to a Mobile Telephone Switching Center (MSC) **25** for providing control and other known cellular radio communications system functions. As shown, the MSC typically includes a cellular processor **28** and a cellular switch **29**. The cellular switch **29** of the MSC **25** is connected to and provides the interface to other associated communications networks, such as the Public Switched Telephone Network (PSTN) **30**. The radio base stations **23** and the MSC **25** generally define the cellular radio network. The design of cellular radio communications systems is well known to those having skill in the art and will therefore not be described further herein. It is noted, however, that the present invention can be used with any cellular system, either analog or digital.

A cellular telephone **21** is also schematically illustrated in FIG. **1**. It will be understood that each radio base station **23** is adapted to communicate with the cellular telephones **21** in its cell **36**. The other communications networks **30** to which the MSC **25** is connected, such as the PSTN, are also in communication with one or more telephones, such as the wire line telephone **33** illustrated in FIG. **1**. Thus, a duplex radio communication signal **32** can be affected through the cellular radio communications system **20** between two cellular telephones **21**, or between a cellular telephone and a wire line telephone **33**.

The cellular radio communications system of the present invention also includes a prioritized routing list of a plurality of telephone numbers. Each telephone number of the routing list is assigned to a telephone associated with a predetermined subscriber of the cellular radio communications system **20**. For example, in addition to a cellular telephone **21**, the predetermined subscriber of the cellular radio communications system **20** also generally has a work telephone and a home telephone. The work telephone and the home telephone need not be cellular telephones, but can, instead, be wire line telephones. In addition, each of the telephones associated with the predetermined subscriber is generally assigned a different telephone number.

As shown in FIGS. **2A** and **2B**, the prioritized routing list **38** includes a listing of the telephone numbers assigned to telephones associated with the predetermined subscriber. The telephone numbers are ranked from a highest priority to a lowest priority. Typically, the subscriber initially assigns the relative priorities to the plurality of associated telephone numbers. Accordingly, the subscriber generally assigns the highest priority to the telephone number assigned to the telephone from which the subscriber is most likely to respond. The subscriber then typically assigns the relative priorities to the remaining telephone numbers such that telephone numbers assigned to telephones from which the subscriber is more likely to respond are assigned higher priorities and telephone numbers assigned to telephones from which the subscriber is less likely to respond are assigned lower priorities.

For example, the predetermined subscriber could have a portable cellular telephone **21** from which the subscriber is most likely to respond, a work telephone and a home telephone from which the subscriber is least likely to respond. As shown in FIG. **2A**, the predetermined subscriber can thus assign the highest priority (10) to the telephone number assigned to the portable cellular telephone **21**, a medium priority (7) to the telephone number assigned to the work telephone, and the lowest priority (1) to the telephone number assigned to the home telephone. The subscriber can, however, assign priorities to the telephone numbers to any desired manner without departing from the spirit and scope of the present invention. Moreover, automatic initial assignment of the respective priorities can also be provided. In addition, the numerical priority designations (i.e., 1, 7, 10) are for purposes of example and other means of designating the relative priorities of the telephone number associated with the predetermined subscriber can be employed.

The cellular radio communications system also includes communications link establishing means, responsive to the prioritized routing list, for establishing a communications link, such as a duplex radio communications signal **32**, between the predetermined subscriber and a source telephone placing a telephone call to a predetermined telephone number associated with the subscriber. The predetermined telephone number associated with the subscriber is typically assigned to the subscriber and is generally different from each of the telephone numbers assigned to the telephones associated with the subscriber. However, the predetermined telephone number can be the same number as that assigned to a cellular telephone of the subscriber.

The communications link establishing means sequentially alerts the telephones associated with the predetermined subscriber according to the prioritized routing list **38** of telephone numbers associated with the subscriber. Thus, the communications link establishing means initially alerts the telephone associated with the subscriber which is assigned the highest priority, such as by creating an audible ringing or

buzzing, for example. If the subscriber does not respond to the alert, the communications link establishing means sequentially alerts each telephone associated with the subscriber according to a descending order of priorities such that the telephone assigned the lowest priority is alerted last.

As illustrated in FIG. 2B, two or more telephones can be assigned the same priority without departing from the spirit and scope of the present invention. For example, work telephone 1 and work telephone 2 can be assigned the same priority (10). According to the present invention, telephones which are assigned an identical priority are simultaneously alerted once all telephones having a higher priority have been alerted and no response has been received from the subscriber. If the subscriber does not respond to the alert of either of the telephones having an identical priority, the remaining telephones associated with the subscriber are sequentially alerted according to a descending order of priorities as described above.

This alerting of the telephones according to the prioritized routing list 38 generally continues until either the subscriber responds to an alert or until each telephone associated with the subscriber and listed in the prioritized routing list has been alerted. If the subscriber does not respond following the alerting of each telephone associated with the subscriber and listed in the prioritized routing list 38, a message can be transmitted to the source telephone placing the telephone call to the predetermined telephone number, informing the calling party that the called subscriber is unavailable. Since each telephone listed in the prioritized routing list 38 is sequentially alerted if the subscriber does not respond, the subscriber need only provide and the calling party need only dial the predetermined telephone number assigned to the subscriber and not each telephone number assigned to a telephone associated with the subscriber.

The communications link establishing means can also include timer means for determining if the subscriber has responded to an alert of a first telephone within a predetermined time period. If the subscriber does not respond to the alert of the first telephone within the predetermined time period, the communications link establishing means can then alert a second telephone associated with the subscriber according to the prioritized routing list 38. The subscriber or the system operator typically selects a predetermined time period for which each telephone is alerted. The predetermined time period is preferably selected such that each telephone associated with the subscriber can be alerted without requiring the calling party to wait an inordinate length of time to determine if the subscriber is available.

In one embodiment of the present invention, the communications link establishing means can cease alerting the telephones associated with the subscriber according to the prioritized routing list 38 before the subscriber ever responds and without alerting each associated telephone. The communications link establishing means generally only ceases alerting the telephones before the subscriber responds and without alerting each associated telephone in a limited number of instances which are generally defined or selected by the subscriber in advance. For example, a subscriber who knows that they will not be in the vicinity of one or more of the telephones on the prioritized routing list 38 can instruct the communications link establishing means, typically by entering commands via a keypad associated with one of the telephones, to skip or bypass, i.e., not alert, the one or more telephones which the subscriber will not be near. In a similar fashion, the subscriber can instruct the communications link establishing means to skip all telephones in the prioritized routing list 38 which have a lower priority than a predetermined one of the associated telephones if the subscriber does not respond to the alert of the predetermined telephone.

Alternatively, a subscriber can instruct the communications link to forward all telephone calls placed to a predetermined one of the telephones in the prioritized routing list 38 to another predefined telephone. Thus, instead of alerting the predetermined telephone according to the prioritized routing list 38, the other predefined telephone will be alerted. Therefore, the subscriber can effectively transfer telephone calls from any of the telephones associated with the subscriber to a telephone that is not listed in the prioritized routing list 38, such as the telephone of an acquaintance with whom the subscriber is visiting.

In addition, the communications link establishing means typically ceases alerting the telephones associated with the subscriber before the subscriber responds and without alerting each associated telephone in instances in which a telephone on the prioritized routing list 38 is already in use. In this instance, the communications link establishing means can skip all telephones on the prioritized routing list 38 which have an intermediate priority and can, instead, alert the telephone having the lowest priority which is generally an answering machine. Alternatively, the communications link establishing means can cease alerting any further telephones and can provide the calling party with a message that the subscriber is temporarily unavailable or that the subscriber's telephone is already in service. Thus, the communications link establishing means can more efficiently attempt to alert the subscriber and to establish a communications link with the party placing the telephone call.

The cellular radio communications system of the present invention also includes reprioritizing means, responsive to the communications link establishing means, for sorting the prioritized routing list 38 of telephone numbers associated with the predetermined subscriber. The reprioritizing means sorts the prioritized routing list 38 following each telephone call placed to the subscriber to which the subscriber responds such that the telephone from which the subscriber most recently responded to the alert is assigned the highest priority. Accordingly, the telephone from which the subscriber most recently responded and which is now assigned the highest priority will be initially alerted by the communications link establishing means in response to the next telephone call placed to the predetermined telephone number associated with the subscriber.

The prioritized routing list 38 is updated such that the telephone from which the subscriber has most recently responded to an alert is initially alerted in response to the next telephone call placed to the subscriber. Thus, the calling party will, on average, establish a communications link with the subscriber more rapidly, and therefore more efficiently, according to the present invention since the subscriber is generally more likely to be in the vicinity and to respond to the alert of the telephone from which the subscriber most recently responded.

The reprioritizing means preferably includes telephone number determining means for determining the telephone number assigned to the telephone from which the subscriber responded to the alert. The telephone number determined can then be assigned the highest priority by the reprioritizing means. The reprioritizing means also generally includes ranking means for designating the telephone number assigned to the telephone from which the subscriber most recently responded to an alert with the highest ranking of the prioritized routing list. The ranking means also maintains the relative rankings of the telephone numbers assigned to the

other telephones associated with the subscriber and from which the subscriber did not respond to the alert.

For example, in the example described hereinabove in which the subscriber's cellular telephone was initially assigned the highest priority, the subscriber's work telephone was initially assigned a medium priority and the subscriber's home telephone was initially assigned the lowest priority, a telephone call is placed to the predetermined telephone number of the subscriber who responds to an alert at their work telephone. The ranking means will then assign the work telephone the highest priority and will retain the relative rankings of the other telephone such that the cellular telephone will be assigned the medium priority and the home telephone will be assigned the lowest priority.

If the subscriber responds to an alert of one of a plurality of telephones which are assigned an identical priority and which are simultaneously alerted, each of the telephones initially assigned an identical priority can be assigned the same, highest priority. Thus, each of the telephones having the same highest priority will be initially alerted in unison in response to the next telephone call place to the user.

Alternatively, if the subscriber responds to an alert of one of a plurality of telephones which are assigned an identical priority and which are simultaneously alerted, the particular telephone from which the subscriber responded can be reassigned the highest priority and the remaining telephones which were originally assigned the same initial priority can maintain that same priority. Thus, the particular telephone from which the subscriber responded will be the only telephone that is initially alerted in response to the next telephone call placed to the subscriber.

In one embodiment of the present invention, the reprioritizing means includes means **55** for sorting the prioritized routing list **38** following each telephone call placed from a telephone associated with a subscriber. This sorting following each telephone call placed from a telephone associated with the subscriber further increases the efficiency with which the communications link establishing means establishes communications between the subscriber and a calling party since, at the time at which the call was placed, the subscriber was likely to be near the telephone from which the call was placed.

The MSC **25** of one embodiment of the cellular radio communications system **20** can include the prioritized routing list **38**, the communications link establishing means and the reprioritizing means. In this embodiment, the predetermined telephone number assigned to the subscriber to which a calling party places a telephone call in order to initiate the system and method of the present invention is maintained within the MSC **25** in association with the prioritized routing list **38** of telephone numbers assigned to telephones associated with the subscriber.

Another embodiment of the cellular radio communications system **20** includes a feature node **34**, responsive to the cellular radio network, and associated with the MSC **25**. Although not illustrated, the feature node **34** can also be associated with the PSTN or other communications network **30** to provide predetermined functions to both the telephones **33** associated with the PSTN and the cellular telephones **21** associated with the cellular radio communications network **20** via the interface established between the MSC and the associated PSTN. Still further, the feature node **34** can be associated with only predetermined subscribers of a cellular radio communications network **20**, such as the plurality of telephones of a business. In this example, the feature node can be embodied in a computer, such as a personal computer, that is communicably connected to the plurality of telephones of the business.

Although the feature node **34** is illustrated as a discrete block in FIG. **1**, all or a portion of the feature node **34** can actually be incorporated within the MSC **25** or the Home Location Register (HLR). In addition, while the feature node **34** is shown as a single block in FIG. **1** for purposes of illustration, the feature node **34** can be distributed within the cellular radio communications system **20** without departing from the spirit and scope of the invention. For example, a portion of the feature node **34** can be incorporated within the HLR **25** while the remainder of the feature node **34** can be external to, but associated with, the MSC. Thus, the feature node **34** may not require a dedicated controller, memory and modem (in analog applications), but can instead, share such resources, such as a modem pool, with other components of the cellular radio communications system **20**.

As described hereinabove, the feature node **34** provides predetermined functions to the plurality of cellular telephones **21** of the cellular radio communications system **20**. In this embodiment of the present invention, the feature node **34** can include the prioritized routing list **38**, the communications link establishing means, and the reprioritizing means. Accordingly, the predetermined telephone number assigned to the subscriber to which a calling party places a telephone call in order to initiate the system and method of the present invention is maintained within the feature node **34** in association with the prioritized routing list **38** of telephone numbers assigned to telephones associated with the subscriber.

More specifically, a controller **40**, such as a microprocessor, and an associated storage means **42**, such as a Random Access Memory (RAM) device of either the MSC **25** or the feature node **34**, according to the particular embodiment of the present invention as described herein above, typically include the prioritized routing list **38**, communications link establishing means **46** and the reprioritizing means **48**. The storage means **42** can be either a discrete memory device associated with the controller **40** or can be the internal memory of the controller.

As shown in FIG. **3**, the controller **40** preferably includes the communications link establishing means **46**, including the timer means **50**, and the reprioritizing means **48**, including the ranking means **52** and the telephone number determining means **54**. Likewise, the storage means **42** preferably includes the prioritized routing list **38**. As illustrated in FIG. **3**, the timer means **50** can include an internal timer of the controller **40**. However, the timer means **50** can also include a software routine executed by the controller **40** to perform the timing function on an external timer associated with the controller without departing from the spirit and scope of the present invention. Accordingly, the predetermined telephone numbers associated with a subscriber as well as the prioritized routing list **38** can be retained by the storage means **42**. In addition, the associated controller **40** can sort the prioritized routing list **38** following each response by the subscriber to assign the telephone number assigned to the telephone from which the subscriber responded with the highest priority.

The source telephone can, for example, be either another cellular telephone **21** or a wire line telephone **33**. In addition, the request for communications is typically a telephone call placed by the calling party from the source telephone. However, the request for communications can also be a request to transmit data, such as a message transmitted to a paging device, a facsimile transmission, an electronic mail message or other types of communications.

Each cellular telephone **21** of a cellular radio communications system **20** need not include or be associated with the prioritized routing list feature since users of cellular telephones which include or are associated with such a feature generally pay an additional fee for the feature. Instead, the cellular radio communications system **20** can be configured such that only predetermined ones of the cellular telephones **21** include or utilize the prioritized routing list feature. Thus, only those subscribers who desire incoming telephone calls to be routed efficiently among a number of telephones associated with the subscriber can select to utilize, and therefore pay for, the feature.

In addition, the user of a cellular telephone **21** who has selected the prioritized routing list feature can subsequently remove this feature if, for example, the user is not frequently utilizing the feature. Alternatively, the user of a cellular telephone **21** who has not initially selected the prioritized routing list feature can subsequently select or add the feature as desired.

Referring now to FIG. **4**, detailed operations for maintaining and sorting the prioritized routing list **38** of telephone numbers according to the present invention are described. Initially, a communications link is attempted to be established between a source telephone placing a telephone call to the predetermined telephone number associated with the subscriber and the predetermined subscriber, as shown in block **58**, by sequentially alerting the telephones associated with the subscriber according to the prioritized routing list **38**. In particular, the telephone assigned the highest priority is initially alerted as illustrated in block **60**. If the subscriber does not respond to the alert of the first telephone within a predetermined time period, the telephone having the next highest priority in the routing list is alerted as shown in blocks **62** and **64**. Each telephone listed in the prioritized routing list **38** is sequentially alerted until either the subscriber responds to the alert or each telephone associated with the subscriber has been alerted and the subscriber has still not responded as shown in block **66**. If each telephone has been alerted without a response from the subscriber, a message can be transmitted to the source telephone indicating that the subscriber is presently unavailable as illustrated in block **68**.

Alternatively, if the subscriber responds to an alert and a communications link is established, the telephone number assigned to the telephone from which the subscriber responded is determined as shown in blocks **70** and **72**. Thereafter, the prioritized routing list **38** is reordered, as illustrated in block **74**, such that the telephone from which the subscriber responded to the alert is assigned the highest priority and will, accordingly, be initially alerted by the communications link establishing means in response to the next telephone call placed to the predetermined telephone number associated with the subscriber. In particular, the telephone number assigned to the telephone from which the subscriber responded is designated with the highest priority of the routing list and the relative rankings of the telephone numbers assigned to the other telephones associated with the subscriber and from which the subscriber did not respond are maintained. Alternatively, upon receipt of a next call, the last called telephone can be alerted, followed by sequential routing through the original prioritized routing list.

Accordingly, telephone calls placed to a subscriber who is associated with a plurality of telephones can be efficiently routed based upon not only the preassigned priorities of the telephones, but also upon information relating to the most recent telephone from which the subscriber responded to an alert. On average, a communications link can thus be established between a calling party and the subscriber more rapidly and, therefore, more efficiently.

The prioritized routing list **38** of the present invention can actually include more than one routing list for each subscriber. Therefore, the subscriber can designate different routing lists, either including different telephone numbers or having different priorities assigned to the same telephone numbers, which are effective for different time periods within a day, for example. The cellular radio communications system **20** can thus also include clock means **56**, associated with the controller **40**, for maintaining a current reference time, such as the time of day and day of the week. Thus, the communications link establishing means can sequentially alert the telephone associated with the subscriber according to the prioritized routing list which was effective at the time that the calling party placed the telephone call.

As an example, a first prioritized routing list can be maintained for a subscriber such that telephone calls placed to the predetermined telephone number associated with the subscriber between the hours of 7:00 a.m. and 6:00 p.m will be routed according to the first routing list. A second prioritized routing list can also be maintained such that telephone calls placed to the predetermined number associated with the subscriber between the hours of 6:00 p.m. and 7:00 a.m. can be routed according to the second routing list. Thus, the subscriber's home telephone can be assigned either a relatively low priority or can be removed altogether from the first prioritized routing list since the subscriber is typically away from their residence during the effective hours of the first routing list. Likewise, the subscriber's work telephone can be either assigned a relatively low priority or can be removed altogether from the second routing list since the subscriber is generally not at their place of business, during the effective hours of the second routing list.

In addition to maintaining multiple prioritized routing lists to each day, the prioritized routing list **38** can include different prioritized routing lists for the different days of the week. For example, different routing lists can be maintained for weekdays and weekends since the subscriber will typically be at their place of business more frequently during the weekdays and their residence more frequently during the weekend. Therefore, the system and method of the present invention can be even more specifically tailored for a subscriber to create even greater efficiencies by using multiple prioritized routing lists for the subscriber.

In the drawings and the specification, there has been set forth preferred embodiments of the invention and, although specific terms are employed, the terms are used in a generic and descriptive sense only and not for purpose of limitation, the scope of the invention being set forth in the following claims.

That which is claimed is:

1. A cellular radio communications system comprising:

a prioritized routing list of a plurality of telephone numbers wherein each telephone number is assigned to a telephone associated with a predetermined subscriber of the cellular radio communications system;

communications link establishing means, responsive to said prioritized routing list, for establishing a communications link between a source telephone placing a telephone call and a predetermined telephone number associated with the predetermined subscriber wherein said communications link establishing means sequentially alerts the telephones associated with the prede-

termined subscriber according to said prioritized routing list of telephone numbers associated with the predetermined subscriber; and

reprioritizing means, responsive to said communications link establishing means, for sorting said prioritized routing list of telephone numbers associated with the predetermined subscriber such that the telephone from which the subscriber responded to the alert is assigned the highest priority and is initially alerted by said communications link establishing means in response to a next telephone call placed to the predetermined telephone number associated with the subscriber;

wherein said reprioritizing means comprises means for sorting said prioritized routing list of telephone numbers associated with the predetermined subscriber after the subscriber places a telephone call from an associated telephone such that the telephone from which the subscriber placed the telephone call is assigned the highest priority and is initially alerted by said communications link establishing means in response to a next telephone call placed to the predetermined telephone number associated with the subscriber.

2. A cellular radio communications system according to claim 1 wherein said prioritized routing list of telephone numbers includes a listing of telephone numbers ranked from a highest priority to a lowest priority, and wherein said reprioritizing means comprises ranking means for designating the telephone number assigned to the telephone from which the subscriber responded to the alert with the highest priority of the prioritized routing list and for maintaining the relative rankings of the telephone numbers assigned to the other telephones associated with the subscriber from which the subscriber did not respond to the alert.

3. A cellular radio communications system according to claim 1 wherein said communications link establishing means comprises timer means for determining if the subscriber has responded to an alert of a first telephone associated with the subscriber within a predetermined time period such that said communications link establishing means can alert a second telephone associated with the subscriber according to said prioritized routing list if the subscriber has not responded to the alert of the first telephone.

4. A cellular radio communications system according to claim 1 wherein said reprioritizing means comprises telephone number determining means for determining the telephone number assigned to the telephone from which the subscriber responded to the alert.

5. A cellular radio communications system according to claim 1 further comprising:

a cellular radio network associated with said prioritized routing list, said communications link establishing means and said reprioritizing means; and

a plurality of cellular telephones responsive to said cellular radio network.

6. A cellular radio communications system according to claim 5 further comprising a feature node, responsive to said cellular radio network, for providing predetermined functions to said plurality of cellular telephones.

7. A cellular radio communications system according to claim 6 wherein said feature node includes said prioritized routing list, said communications link establishing means and said reprioritizing means.

8. A cellular radio communications system according to claim 5 further comprising a mobile switching center, responsive to said cellular radio network, for processing and storing data related to the subscribers of said cellular radio network.

9. A cellular radio communications system according to claim 8 wherein said mobile switching center includes said prioritized routing list, said communications link establishing means and said reprioritizing means.

10. A cellular radio communications system according to claim 1 further comprising:

a plurality of prioritized routing lists, each prioritized routing list including a listing of a plurality of telephone numbers assigned to telephones associated with the predetermined subscriber, each prioritized routing list also associated with a predetermined time period during which the prioritized routing list is effective; and

clock means for maintaining a current reference time;

wherein said communications link establishing means is responsive to both said plurality of prioritized routing lists and said clock means such that the telephones are sequentially alerted according to the prioritized routing list which is effective at the time at which the source telephone placed the telephone call.

11. A mobile telephone switching office of a cellular radio communications system for processing and storing data related to the subscribers of the cellular radio communications system, the telephone mobile switching office comprising:

a prioritized routing list of a plurality of telephone numbers wherein each telephone number is assigned to a telephone associated with a predetermined subscriber of said cellular radio communications system;

communications link establishing means, responsive to said prioritized routing list, for establishing a communications link between a source telephone placing a telephone call and a predetermined telephone number associated with the predetermined subscriber wherein said communications link establishing means sequentially alerts the telephones associated with the predetermined subscriber according to said prioritized routing list of telephone numbers associated with the predetermined subscriber; and

reprioritizing means, responsive to said communications link establishing means, for sorting said prioritized routing list of telephone numbers associated with the predetermined subscriber such that the telephone from which the subscriber responded to the alert is assigned the highest priority and is initially alerted by said communications link establishing means in response to a next telephone call placed to the predetermined telephone number associated with the subscriber;

wherein said reprioritizing means comprises means for sorting said prioritized routing list of telephone numbers associated with the predetermined subscriber after the subscriber places a telephone call from an associated telephone such that the telephone from which the subscriber placed the telephone call is assigned the highest priority and is initially alerted by said communications link establishing means in response to a next telephone call placed to the predetermined telephone number associated with the subscriber.

12. A mobile telephone switching office according to claim 11 wherein said prioritized routing list of telephone numbers includes a listing of telephone numbers ranked from a highest priority to a lowest priority, and wherein said reprioritizing means comprises ranking means for designating the telephone number assigned to the telephone from which the subscriber responded to the alert with the highest priority of the prioritized routing list and for maintaining the relative rankings of the telephone numbers assigned to the

other telephones associated with the subscriber from which the subscriber did not respond to the alert.

13. A mobile telephone switching office according to claim 11 wherein said communications link establishing means comprises timer means for determining if the subscriber has responded to an alert of a first telephone associated with the subscriber within a predetermined time period such that said communications link establishing means can alert a second telephone associated with the subscriber according to said prioritized routing list if the subscriber has not responded to the alert of the first telephone.

14. A mobile telephone switching office according to claim 11 further comprising:

a plurality of prioritized routing lists, each prioritized routing list including a listing of a plurality of telephone numbers assigned to telephones associated with the predetermined subscriber, each prioritized routing list also associated with a predetermined time period during which the prioritized routing list is effective; and

clock means for maintaining a current reference time;

wherein said communications link establishing means is responsive to both said plurality of prioritized routing lists and said clock means such that the telephones are sequentially alerted according to the prioritized routing list which is effective at the time at which the source telephone placed the telephone call.

15. A feature node for providing predetermined functions to a plurality of cellular telephones of a cellular radio communications system, the feature node comprising:

a prioritized routing list of a plurality of telephone numbers wherein each telephone number is assigned to a telephone associated with a predetermined subscriber of said cellular radio communications system;

communications link establishing means, responsive to said prioritized routing list, for establishing a communications link between a source telephone placing a telephone call and a predetermined telephone number associated with the predetermined subscriber wherein said communications link establishing means sequentially alerts the telephones associated with the predetermined subscriber according to said prioritized routing list of telephone numbers associated with the predetermined subscriber; and

reprioritizing means, responsive to said communications link establishing means, for sorting said prioritized routing list of telephone numbers associated with the predetermined subscriber such that the telephone from which the subscriber responded to the alert is assigned the highest priority and is initially alerted by said communications link establishing means in response to a next telephone call placed to the predetermined telephone number associated with the subscriber;

wherein said reprioritizing means comprises means for sorting said prioritized routing list of telephone numbers associated with the predetermined subscriber after the subscriber places a telephone call from an associated telephone such that the telephone from which the subscriber placed the telephone call is assigned the highest priority and is initially alerted by said communications link establishing means in response to a next telephone call placed to the predetermined telephone number associated with the subscriber.

16. A feature node according to claim 15 wherein said prioritized routing list of telephone numbers includes a listing of telephone numbers ranked from a highest priority to a lowest priority, and wherein said reprioritizing means comprises ranking means for designating the telephone number assigned to the telephone from which the subscriber responded to the alert with the highest priority of said prioritized routing list and for maintaining the relative rankings of the telephone numbers assigned to the other telephones associated with the subscriber from which the subscriber did not respond to the alert.

17. A feature node according to claim 15 wherein said communications link establishing means comprises timer means for determining if the subscriber has responded to an alert of a first telephone associated with the subscriber within a predetermined time period such that said communications link establishing means can alert a second telephone associated with the subscriber according to said prioritized routing list if the subscriber has not responded to the alert of the first telephone.

18. A feature node according to claim 15 further comprising:

a plurality of prioritized routing lists, each prioritized routing list including a listing of a plurality of telephone numbers assigned to telephones associated with the predetermined subscriber, each prioritized routing list also associated with a predetermined time period during which the prioritized routing list is effective; and

clock means for maintaining a current reference time;

wherein said communications link establishing means is responsive to both said plurality of prioritized routing lists and said clock means such that the telephones are sequentially alerted according to the prioritized routing list which is effective at the time at which the source telephone placed the telephone call.

19. A method of sorting a prioritized routing list of telephone numbers assigned to a plurality of telephones associated with a predetermined subscriber of a cellular radio communications system, the method comprising the steps of:

sequentially alerting the telephones associated with the predetermined subscriber according to the prioritized routing list of telephone numbers associated with the predetermined subscriber; and

reordering the prioritized routing list of telephone numbers associated with the predetermined subscriber such that the telephone number of the telephone from which the subscriber responded to the alert is assigned the highest priority and will be initially alerted in response to the next telephone call placed to the predetermined telephone number associated with the subscriber;

wherein the prioritized routing list of telephone numbers includes a listing of telephone numbers ranked from a highest priority to a lowest priority, and wherein said reordering step comprises the step of designating the telephone number of a telephone associated with the subscriber from which the subscriber placed a telephone call with the highest priority and maintaining the relative rankings of the telephone numbers assigned to the other telephones associated with the subscriber from which the subscriber did not place the telephone call.

20. A method for sorting a prioritized routing list of telephone numbers according to claim 19 wherein the prioritized routing list of telephone numbers includes a listing of telephone numbers ranked from a highest priority to a lowest priority, and wherein said reordering step comprises the steps of designating the telephone number assigned to the telephone from which the subscriber responded to the

alert with the highest priority of the prioritized routing list and maintaining the relative rankings of the telephone numbers assigned to the other telephones associated with the subscriber from which the subscriber did not respond to the alert.

21. A method for sorting a prioritized routing list of telephone number according to claim 19 further comprising the step of establishing a communications link between a source telephone placing a telephone call and a predetermined telephone number associated with the predetermined subscriber and the predetermined subscriber when the subscriber responds to an alert of an associated telephone.

22. A method for sorting a prioritized routing list of telephone numbers according to claim 19 wherein said step of establishing a communications link comprises the steps of:

determining if the subscriber has responded to an alert of a first telephone associated with the subscriber within a predetermined time period; and

if the subscriber has not responded to the alert of the first telephone, alerting a second telephone associated with the subscriber according to the prioritized routing list.

23. A method for sorting a prioritized routing list of telephone numbers according to claim 19 wherein the cellular radio communications system includes a plurality of prioritized routing lists, each prioritized routing list including a listing of a plurality of telephone numbers assigned to telephones associated with the predetermined subscriber, each prioritized routing list also associated with a predetermined time period during which the prioritized routing list is effective, the method further comprising the step of maintaining a current reference time.

24. A method for sorting a prioritized routing list of telephone numbers according to claim 23 wherein said sequential alerting step comprises the steps of:

determining the prioritized routing list which is effective at the time a telephone call was placed to the predetermined subscriber; and

sequentially alerting the telephone associated with the predetermined subscriber according to the effective prioritized routing list.

25. A method for sorting a prioritized routing list of telephone numbers according to claim 19 further comprising the step of determining the telephone number assigned to the telephone from which the subscriber responded to the alert.

26. A cellular radio communications system comprising:

a prioritized routing list of a plurality of telephone numbers wherein each telephone number is assigned to a telephone associated with a predetermined subscriber of the cellular radio communications system;

communications link establishing means, responsive to said prioritized routing list, for establishing a communications link between a source telephone placing a telephone call and a predetermined one of said assigned telephone numbers wherein said communications link establishing means sequentially alerts the telephones associated with the predetermined subscriber according to said prioritized routing list of telephone numbers associated with the predetermined subscriber; and

reprioritizing means, responsive to said communications link establishing means, for sorting said prioritized routing list of telephone numbers associated with the predetermined subscriber such that the telephone from which the subscriber responded to the alert is assigned the highest priority and is initially alerted by said communications link establishing means in response to a next telephone call placed to the predetermined telephone number associated with the subscriber.

27. A cellular radio communications system according to claim 26 wherein said predetermined assigned telephone number is assigned to a cellular radiotelephone assigned to the predetermined subscriber.

28. A mobile telephone switching office of a cellular radio communications system for processing and storing data related to the subscribers of the cellular radio communications system, the telephone mobile switching office comprising:

a prioritized routing list of a plurality of telephone numbers wherein each telephone number is assigned to a telephone associated with a predetermined subscriber of said cellular radio communications system;

communications link establishing means, responsive to said prioritized routing list, for establishing a communications link between a source telephone placing a telephone call and a predetermined one of said assigned telephone numbers wherein said communications link establishing means sequentially alerts the telephones associated with the predetermined subscriber according to said prioritized routing list of telephone numbers associated with the predetermined subscriber; and

reprioritizing means, responsive to said communications link establishing means, for sorting said prioritized routing list of telephone numbers associated with the predetermined subscriber such that the telephone from which the subscriber responded to the alert is assigned the highest priority and is initially alerted by said communications link establishing means in response to a next telephone call placed to the predetermined telephone number associated with the subscriber.

29. A mobile telephone switching office according to claim 28 wherein said predetermined assigned telephone number is assigned to a cellular radiotelephone assigned to the predetermined subscriber.

30. A feature node for providing predetermined functions to a plurality of cellular telephones of a cellular radio communications system, the feature node comprising:

a prioritized routing list of a plurality of telephone numbers wherein each telephone number is assigned to a telephone associated with a predetermined subscriber of said cellular radio communications system;

communications link establishing means, responsive to said prioritized routing list, for establishing a communications link between a source telephone placing a telephone call and a predetermined one of said assigned telephone numbers wherein said communications link establishing means sequentially alerts the telephones associated with the predetermined subscriber according to said prioritized routing list of telephone numbers associated with the predetermined subscriber; and

reprioritizing means, responsive to said communications link establishing means, for sorting said prioritized routing list of telephone numbers associated with the predetermined subscriber such that the telephone from which the subscriber responded to the alert is assigned the highest priority and is initially alerted by said communications link establishing means in response to a next telephone call placed to the predetermined telephone number associated with the subscriber.

31. A feature node according to claim 30 wherein said predetermined assigned telephone number is assigned to a cellular radiotelephone assigned to the predetermined subscriber.

* * * * *

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(12) **United States Patent**
Johnson

(10) **Patent No.: US 6,735,292 B1**
(45) **Date of Patent: May 11, 2004**

(54) **METHOD AND SYSTEM FOR PRIORITY CALL PROCESSING**

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(52) **U.S. Cl.** **379/201.01**; 379/211.02
(58) **Field of Search** 379/201.01–201.05, 379/207.02, 207.11–207.15, 211.01, 211.02, 215.01

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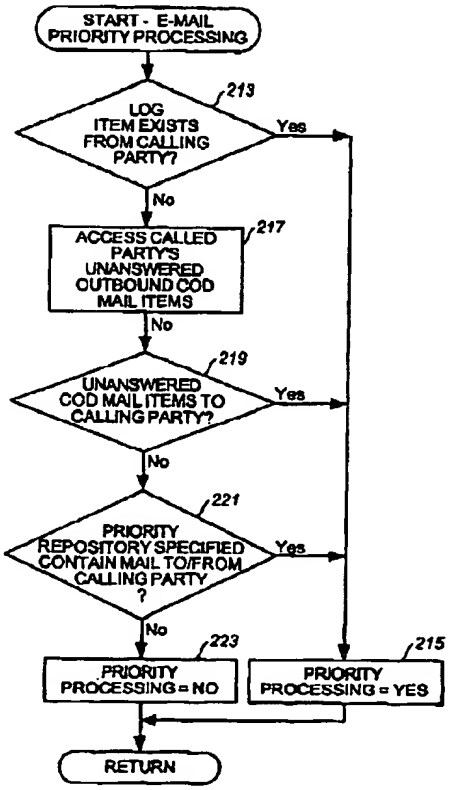
Primary Examiner—Ahmad F. Matar
Assistant Examiner—Quynh H. Nguyen

(57) **ABSTRACT**

A method of and system for providing special call processing based upon called party specified masks and the status of electronic mail, electronic calendar, and voice mail items associated with the called party and a calling party receives a request to set up a call between a calling party number and a called party number. The system determines if the called number is associated with a mask entry that matches the calling number. If so, the system provides special processing of the call based upon the matching mask entry. The mask entry may be specified by digits and or wild card characters. Special processing is specified by a disposition code in the matching mask entry. If the called number is not associated with a mask entry that matches calling number, the system determines if the called party has a call priority setting set to on for at least one of electronic mail, electronic calendar, or voice mail priority processing. If so, the system determines the status of the at least one electronic mail, electronic calendar, and voice mail between the called party and said calling party, and processes the call based upon the status.

20 Claims, 12 Drawing Sheets



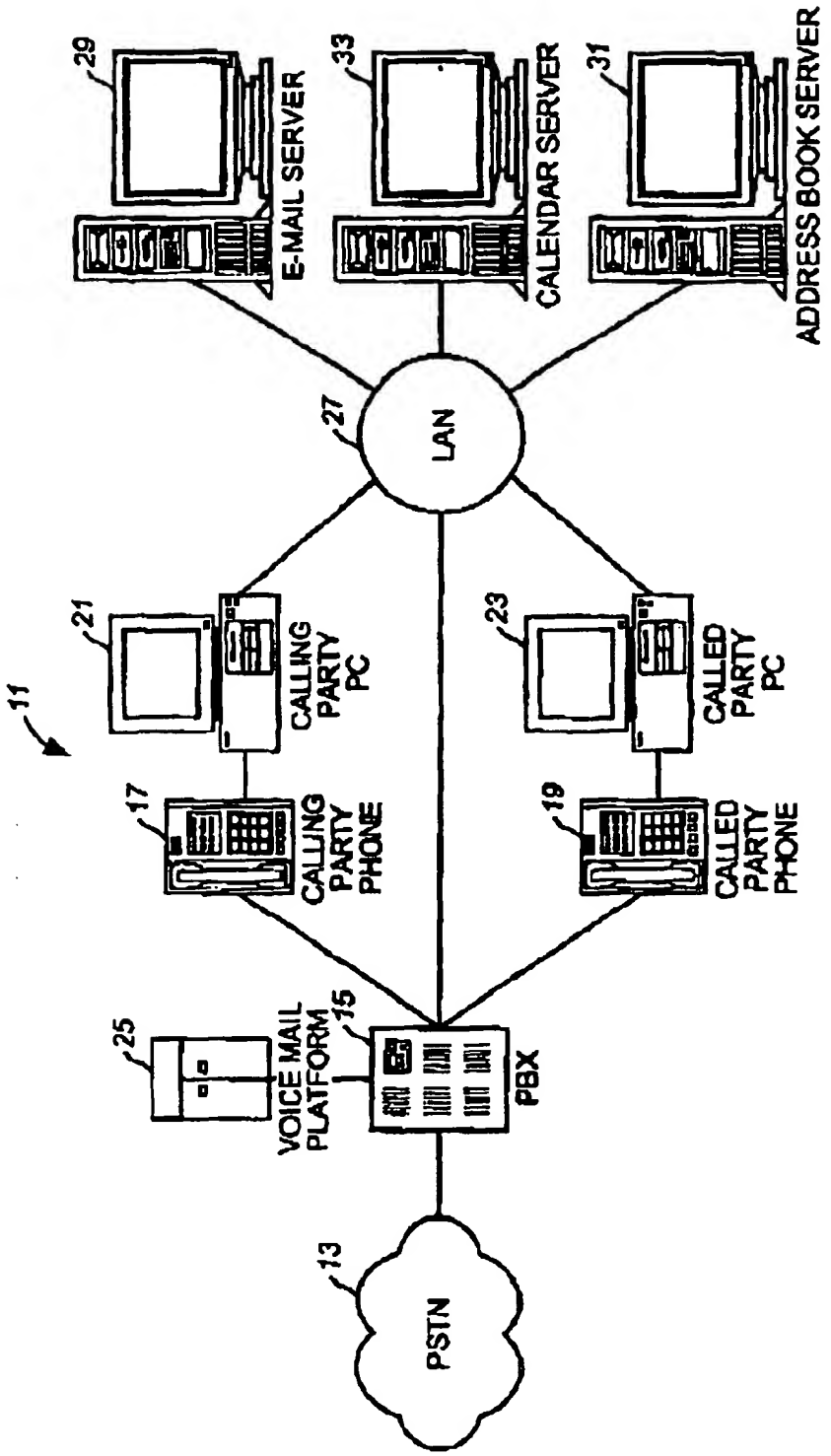

29
E-MAIL SERVER
33
CALENDAR SERVER
31
ADDRESS BOOK SERVER
27
LAN
21
CALLING PARTY PC
23
CALLED PARTY PC
11
17
CALLING PARTY PHONE
19
CALLED PARTY PHONE
25
VOICE MAIL PLATFORM
15
PBX
13
PSTN

FIG. 1

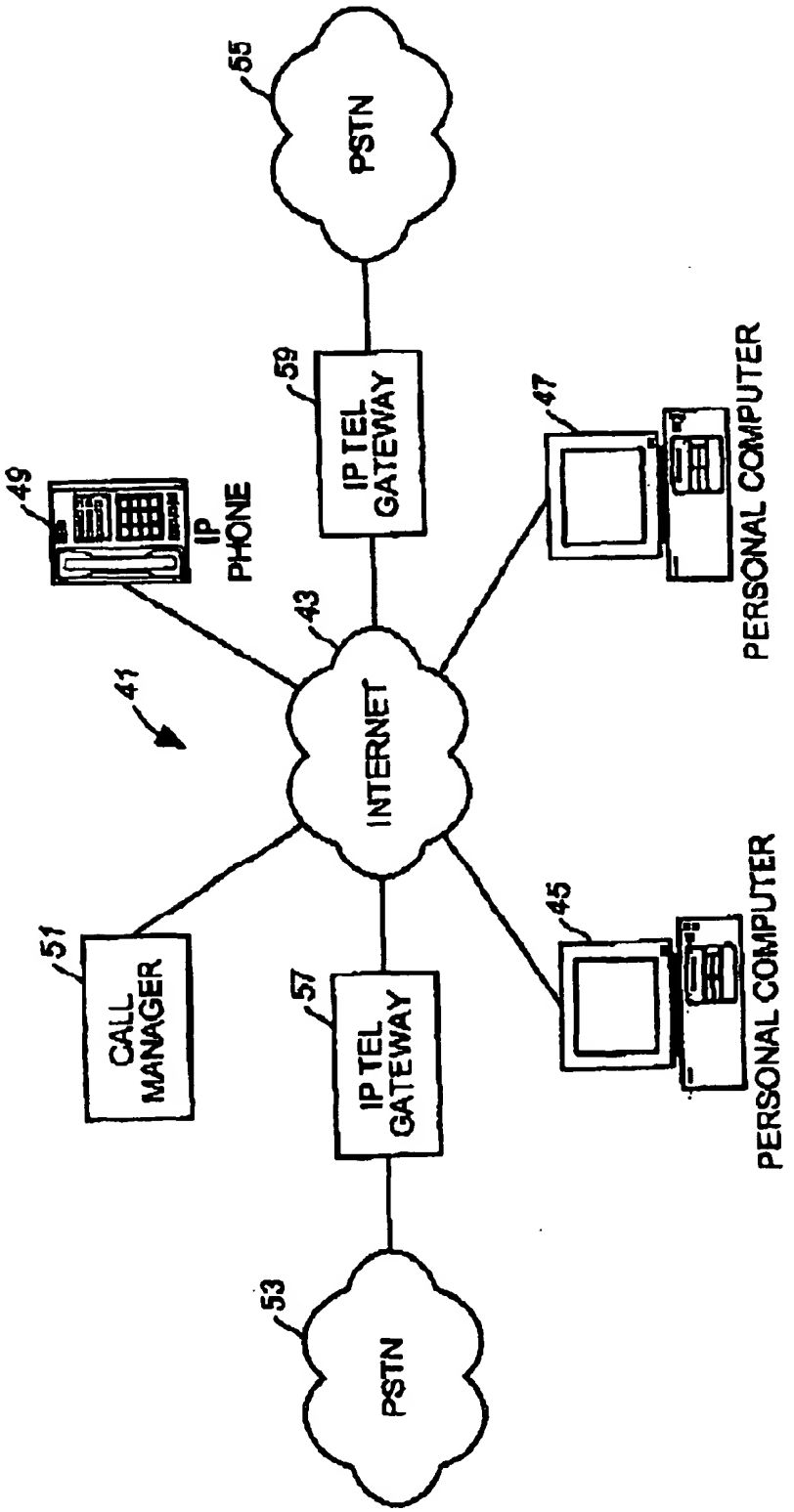

55
PSTN
59
IP TEL GATEWAY
47
PERSONAL COMPUTER
49
IP PHONE
43
41
INTERNET
51
CALL MANAGER
57
IP TEL GATEWAY
45
PERSONAL COMPUTER
53
PSTN

FIG. 2

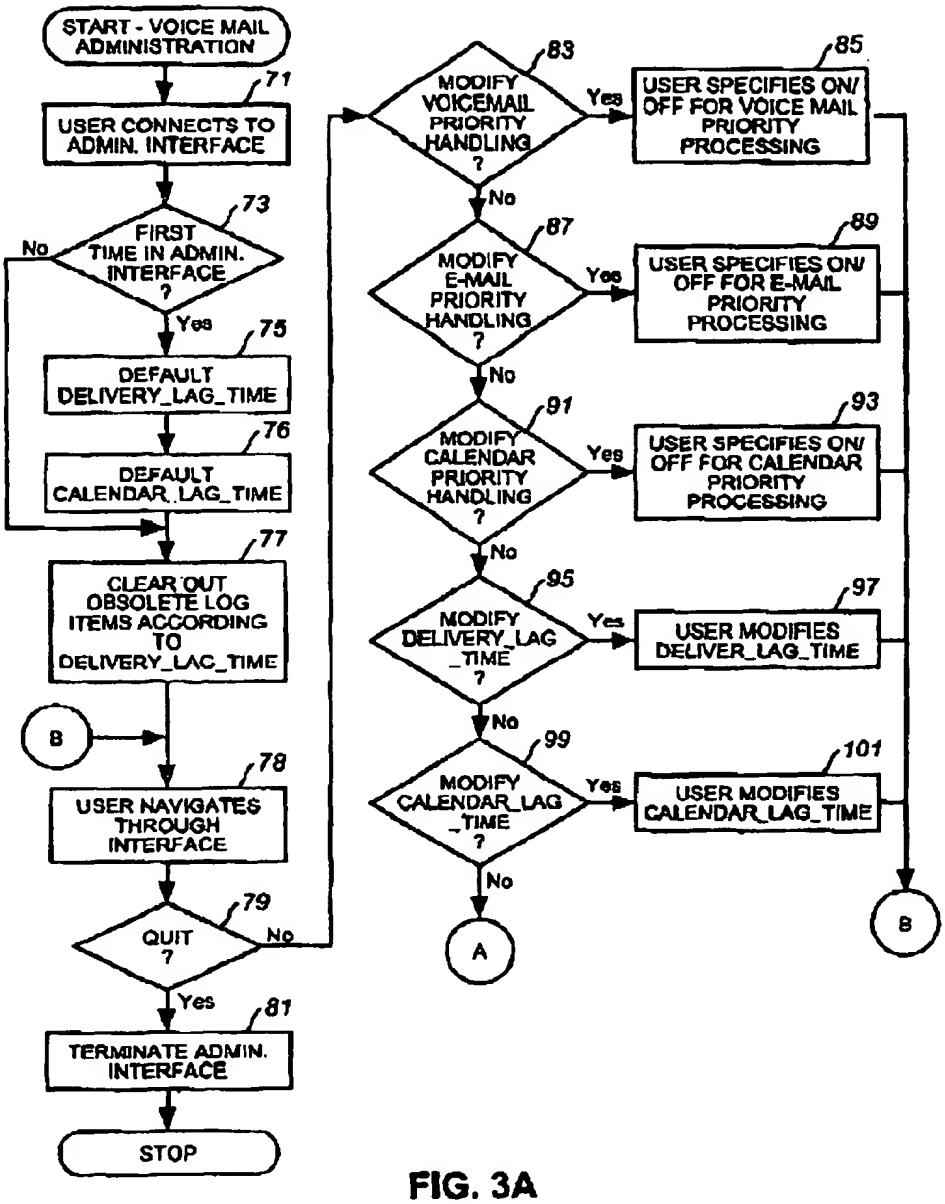

START - VOICE MAIL ADMINISTRATION
71
USER CONNECTS TO ADMIN. INTERFACE
73
FIRST TIME IN ADMIN. INTERFACE ?
No
Yes
75
DEFAULT DELIVERY_LAG_TIME
76
DEFAULT CALENDAR_LAG_TIME
77
CLEAR OUT OBSOLETE LOG ITEMS ACCORDING TO DELIVERY_LAC_TIME
B
78
USER NAVIGATES THROUGH INTERFACE
79
QUIT ?
No
Yes
81
TERMINATE ADMIN. INTERFACE
STOP
83
MODIFY VOICEMAIL PRIORITY HANDLING ?
Yes
85
USER SPECIFIES ON/ OFF FOR VOICE MAIL PRIORITY PROCESSING
No
87
MODIFY E-MAIL PRIORITY HANDLING ?
Yes
89
USER SPECIFIES ON/ OFF FOR E-MAIL PRIORITY PROCESSING
No
91
MODIFY CALENDAR PRIORITY HANDLING ?
Yes
93
USER SPECIFIES ON/ OFF FOR CALENDAR PRIORITY PROCESSING
No
95
MODIFY DELIVERY_LAG _TIME ?
Yes
97
USER MODIFIES DELIVER_LAG_TIME
No
99
MODIFY CALENDAR_LAG _TIME ?
Yes
101
USER MODIFIES CALENDAR_LAG_TIME
No
A
B

FIG. 3A

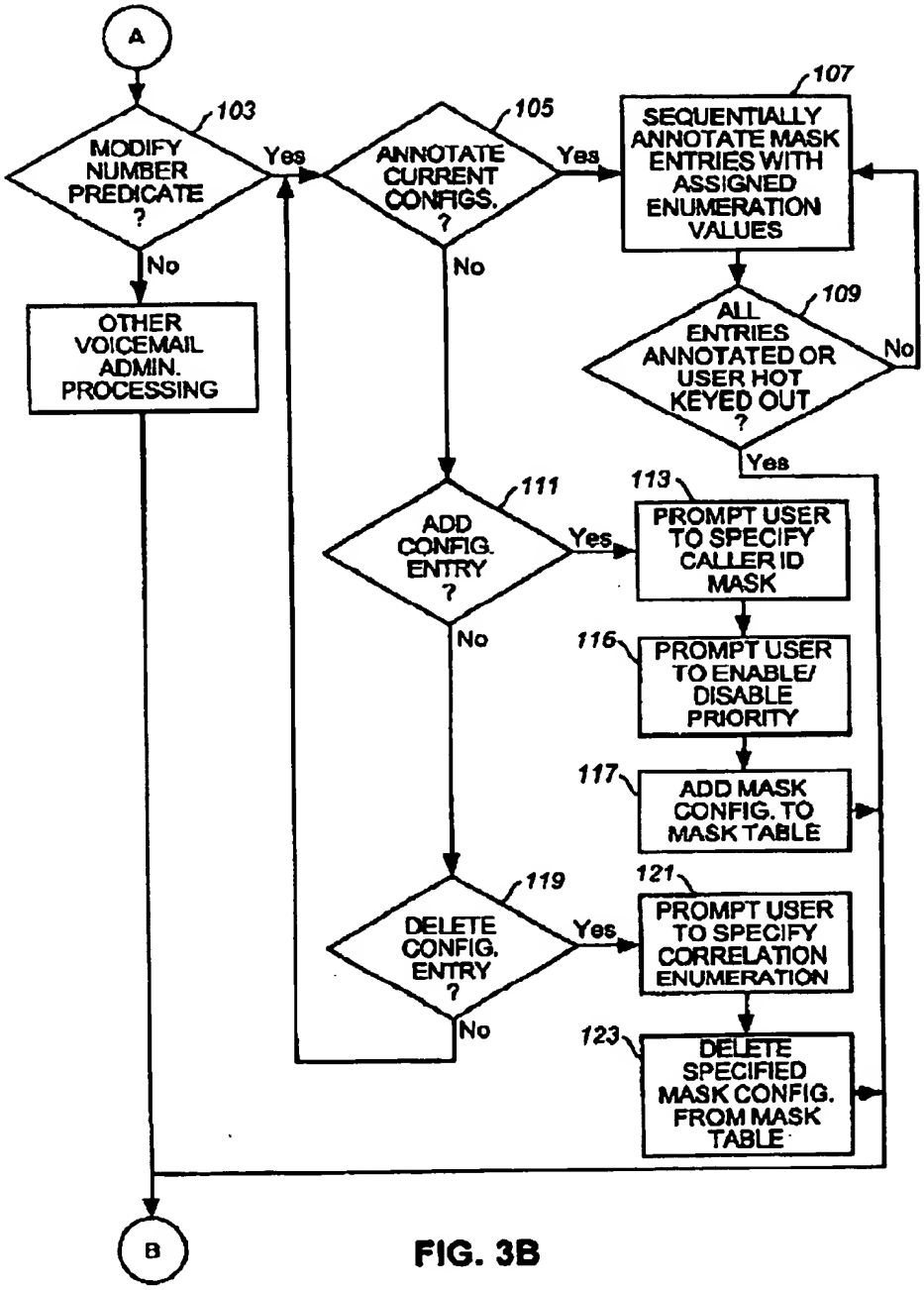

A
103
MODIFY NUMBER PREDICATE ?
Yes
No
105
ANNOTATE CURRENT CONFIGS. ?
Yes
No
107
SEQUENTIALLY ANNOTATE MASK ENTRIES WITH ASSIGNED ENUMERATION VALUES
109
ALL ENTRIES ANNOTATED OR USER HOT KEYED OUT ?
No
Yes
OTHER VOICEMAIL ADMIN. PROCESSING
111
ADD CONFIG. ENTRY ?
Yes
No
113
PROMPT USER TO SPECIFY CALLER ID MASK
116
PROMPT USER TO ENABLE/ DISABLE PRIORITY
117
ADD MASK CONFIG. TO MASK TABLE
119
DELETE CONFIG. ENTRY ?
Yes
No
121
PROMPT USER TO SPECIFY CORRELATION ENUMERATION
123
DELETE SPECIFIED MASK CONFIG. FROM MASK TABLE
B

FIG. 3B

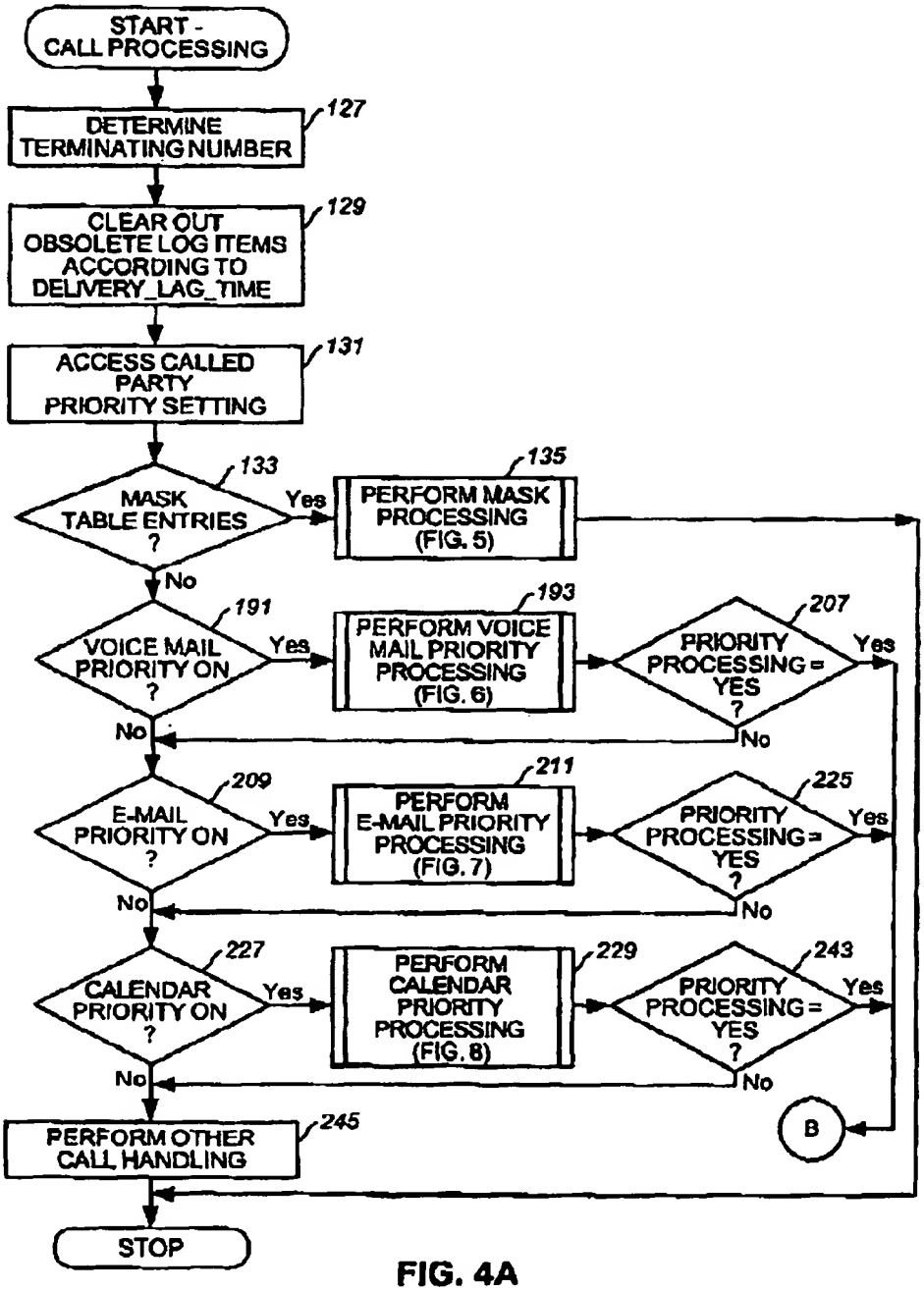

START - CALL PROCESSING
DETERMINE TERMINATING NUMBER
127
CLEAR OUT OBSOLETE LOG ITEMS ACCORDING TO DELIVERY_LAG_TIME
129
ACCESS CALLED PARTY PRIORITY SETTING
131
MASK TABLE ENTRIES ?
133
Yes
PERFORM MASK PROCESSING (FIG. 5)
135
No
VOICE MAIL PRIORITY ON ?
191
Yes
PERFORM VOICE MAIL PRIORITY PROCESSING (FIG. 6)
193
PRIORITY PROCESSING = YES ?
207
Yes
No
No
E-MAIL PRIORITY ON ?
209
Yes
PERFORM E-MAIL PRIORITY PROCESSING (FIG. 7)
211
PRIORITY PROCESSING = YES ?
225
Yes
No
No
CALENDAR PRIORITY ON ?
227
Yes
PERFORM CALENDAR PRIORITY PROCESSING (FIG. 8)
229
PRIORITY PROCESSING = YES ?
243
Yes
No
No
B
PERFORM OTHER CALL HANDLING
245
STOP

FIG. 4A

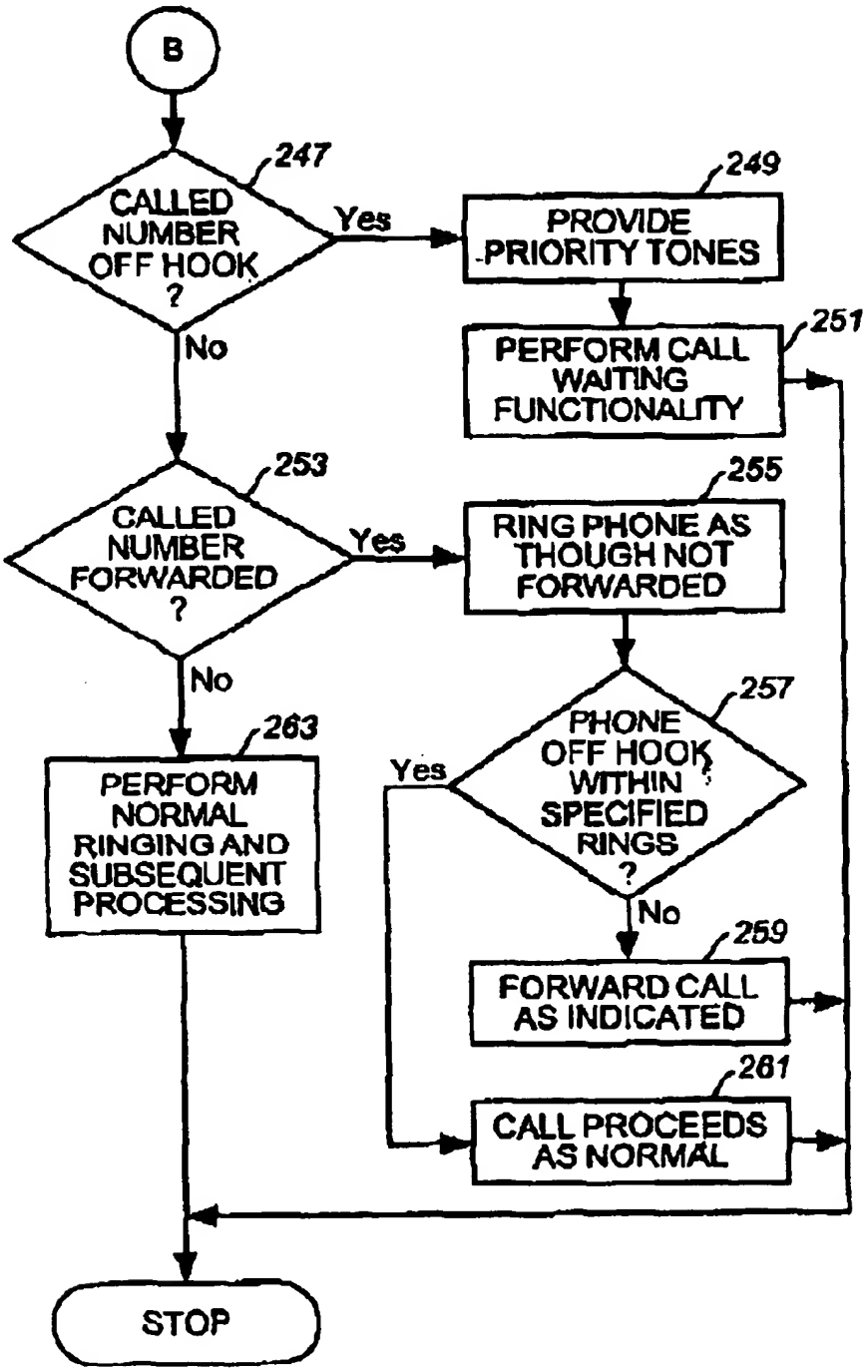

B
247
CALLED NUMBER OFF HOOK ?
Yes
No
249
PROVIDE PRIORITY TONES
251
PERFORM CALL WAITING FUNCTIONALITY
253
CALLED NUMBER FORWARDED ?
Yes
No
255
RING PHONE AS THOUGH NOT FORWARDED
257
PHONE OFF HOOK WITHIN SPECIFIED RINGS ?
Yes
No
259
FORWARD CALL AS INDICATED
261
CALL PROCEEDS AS NORMAL
263
PERFORM NORMAL RINGING AND SUBSEQUENT PROCESSING
STOP

FIG. 4B

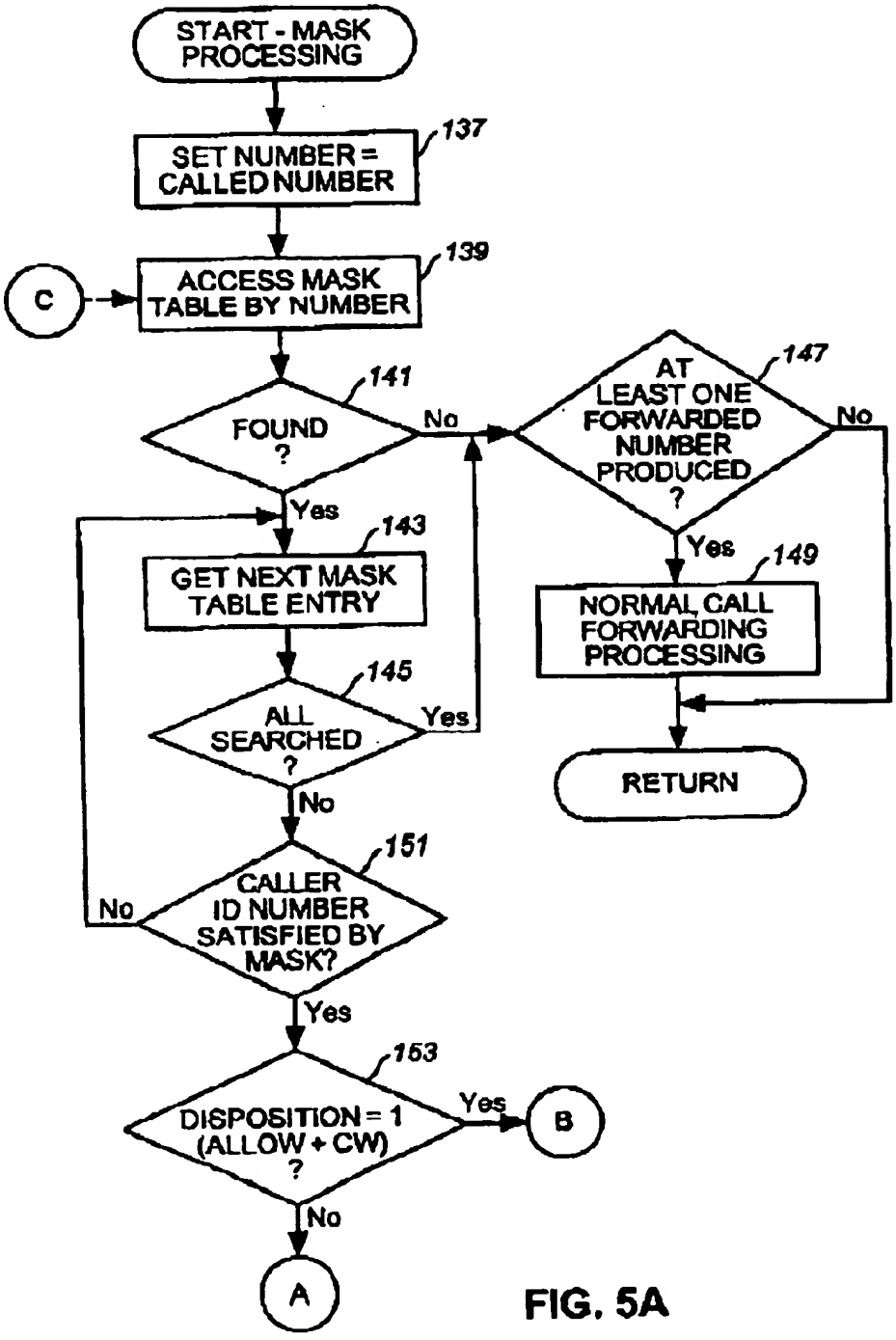

START - MASK PROCESSING
SET NUMBER = CALLED NUMBER
137
ACCESS MASK TABLE BY NUMBER
139
C
FOUND ?
141
No
Yes
AT LEAST ONE FORWARDED NUMBER PRODUCED ?
147
No
Yes
NORMAL CALL FORWARDING PROCESSING
149
RETURN
GET NEXT MASK TABLE ENTRY
143
ALL SEARCHED ?
145
Yes
No
CALLER ID NUMBER SATISFIED BY MASK?
151
No
Yes
DISPOSITION = 1 (ALLOW + CW) ?
153
Yes
B
No
A

FIG. 5A

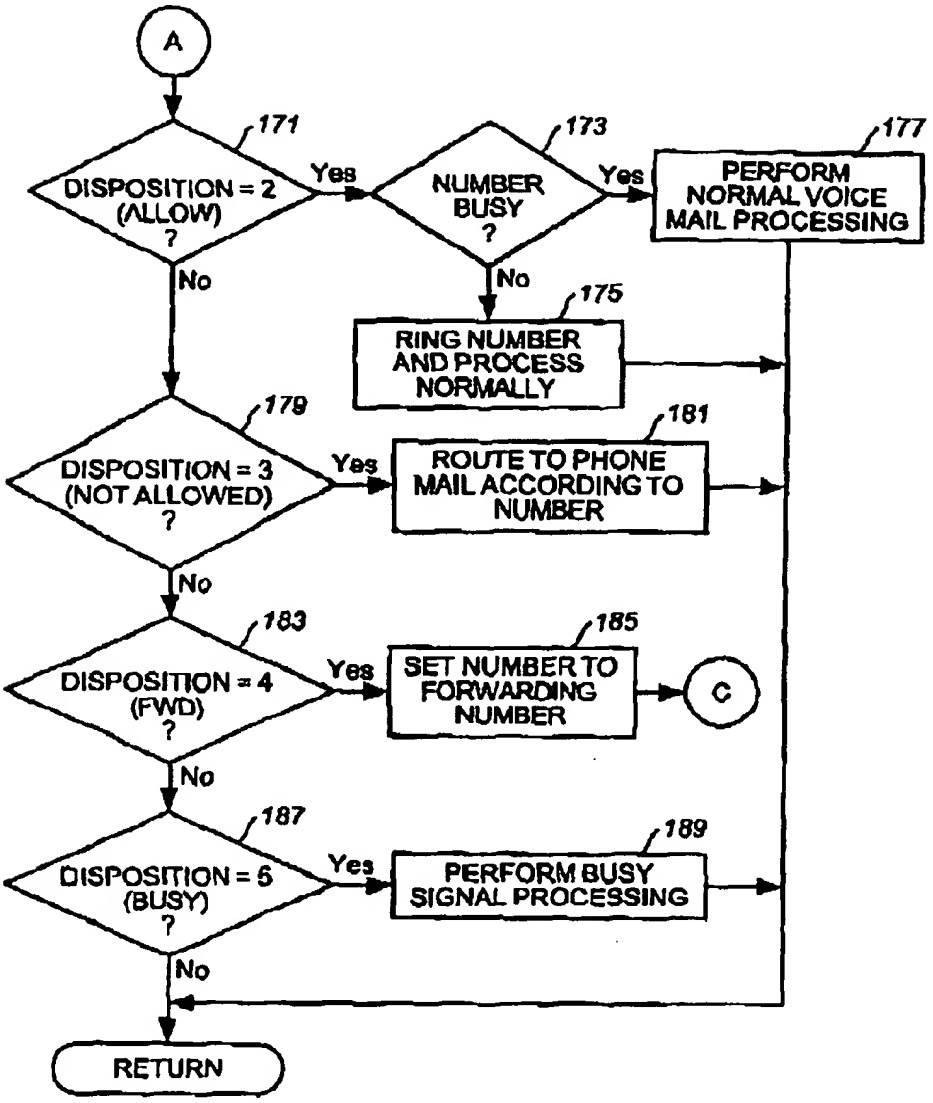

A
171
DISPOSITION = 2 (ALLOW) ?
Yes
173
NUMBER BUSY ?
Yes
177
PERFORM NORMAL VOICE MAIL PROCESSING
No
No
175
RING NUMBER AND PROCESS NORMALLY
179
DISPOSITION = 3 (NOT ALLOWED) ?
Yes
181
ROUTE TO PHONE MAIL ACCORDING TO NUMBER
No
183
DISPOSITION = 4 (FWD) ?
Yes
185
SET NUMBER TO FORWARDING NUMBER
C
No
187
DISPOSITION = 5 (BUSY) ?
Yes
189
PERFORM BUSY SIGNAL PROCESSING
No
RETURN

FIG. 5B

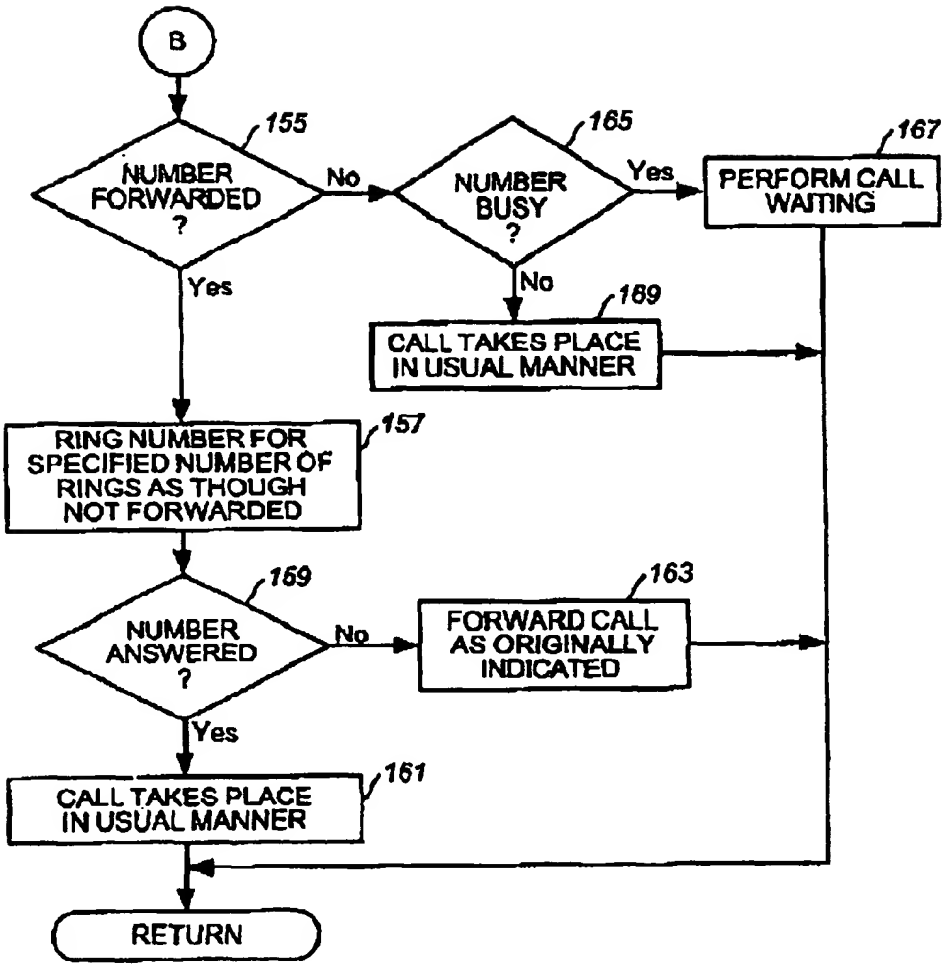

B
155
NUMBER FORWARDED ?
No
165
NUMBER BUSY ?
Yes
167
PERFORM CALL WAITING
Yes
No
169
CALL TAKES PLACE IN USUAL MANNER
157
RING NUMBER FOR SPECIFIED NUMBER OF RINGS AS THOUGH NOT FORWARDED
159
NUMBER ANSWERED ?
No
163
FORWARD CALL AS ORIGINALLY INDICATED
Yes
161
CALL TAKES PLACE IN USUAL MANNER
RETURN

FIG. 5C

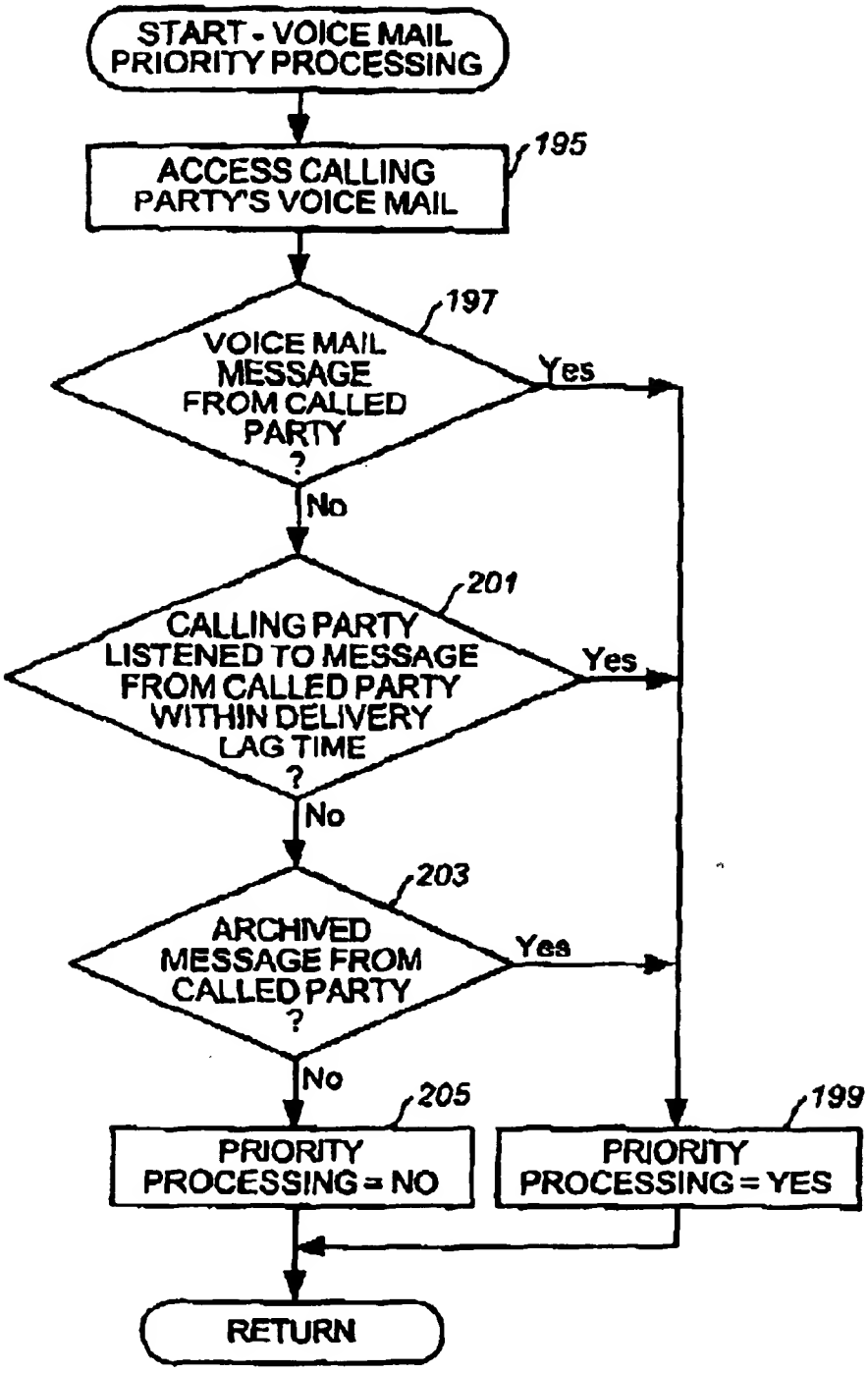

START - VOICE MAIL PRIORITY PROCESSING
ACCESS CALLING PARTY'S VOICE MAIL
195
VOICE MAIL MESSAGE FROM CALLED PARTY ?
197
Yes
No
CALLING PARTY LISTENED TO MESSAGE FROM CALLED PARTY WITHIN DELIVERY LAG TIME ?
201
Yes
No
ARCHIVED MESSAGE FROM CALLED PARTY ?
203
Yes
No
PRIORITY PROCESSING = NO
205
PRIORITY PROCESSING = YES
199
RETURN

FIG. 6

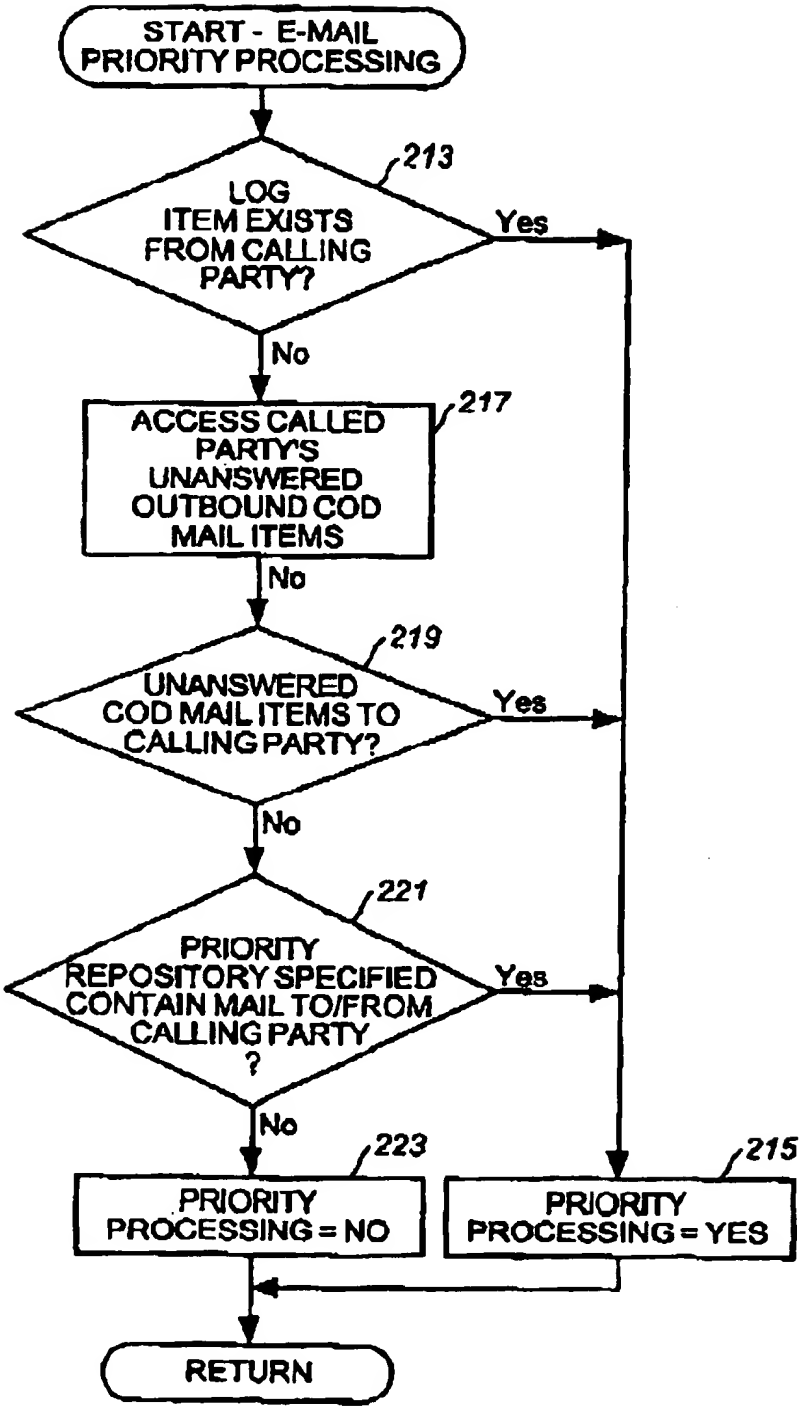

START - E-MAIL PRIORITY PROCESSING
213
LOG ITEM EXISTS FROM CALLING PARTY?
Yes
No
217
ACCESS CALLED PARTY'S UNANSWERED OUTBOUND COD MAIL ITEMS
No
219
UNANSWERED COD MAIL ITEMS TO CALLING PARTY?
Yes
No
221
PRIORITY REPOSITORY SPECIFIED CONTAIN MAIL TO/FROM CALLING PARTY ?
Yes
No
223
PRIORITY PROCESSING = NO
215
PRIORITY PROCESSING = YES
RETURN

FIG. 7

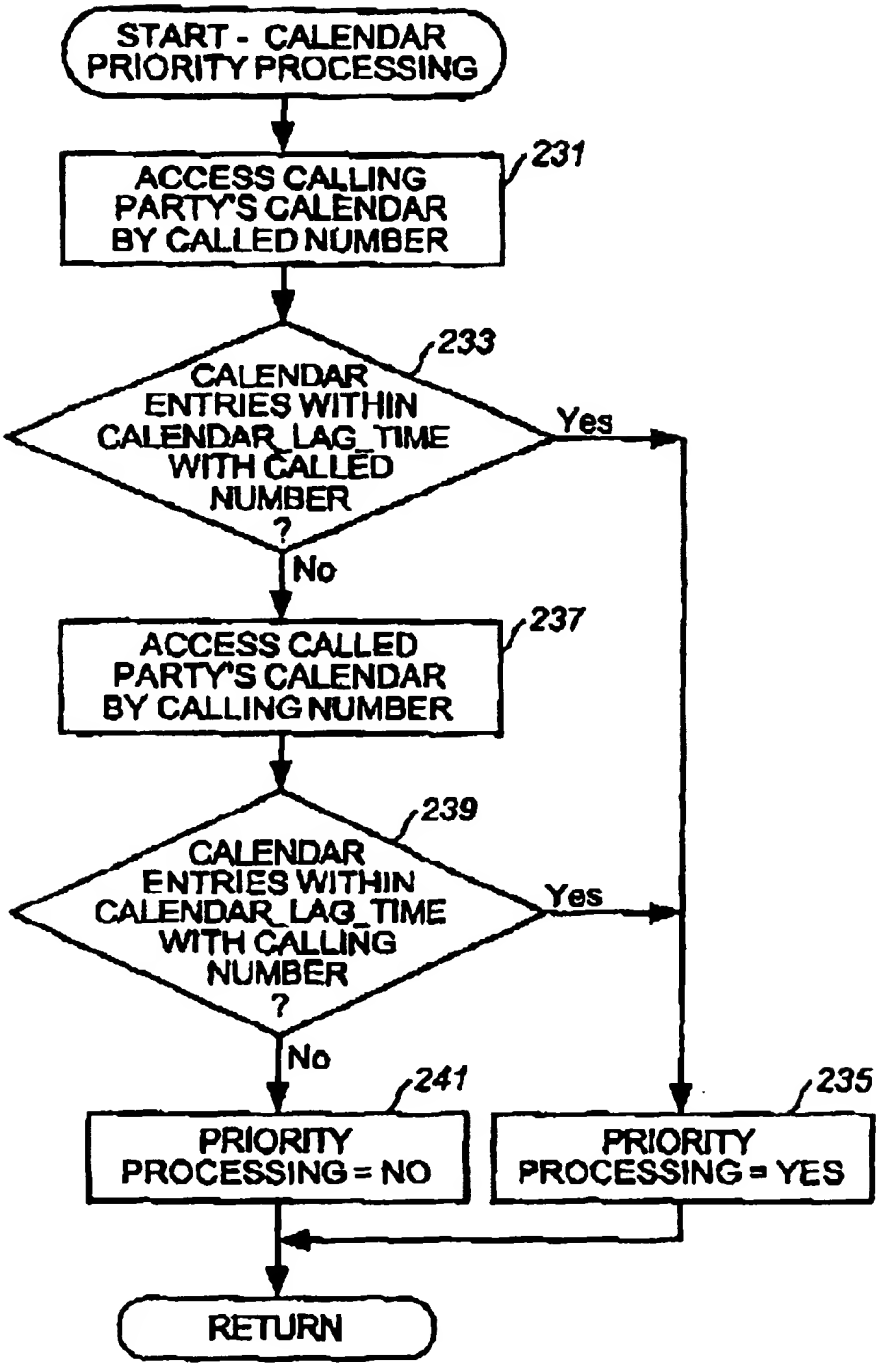

START - CALENDAR PRIORITY PROCESSING
ACCESS CALLING PARTY'S CALENDAR BY CALLED NUMBER
231
CALENDAR ENTRIES WITHIN CALENDAR_LAG_TIME WITH CALLED NUMBER ?
233
Yes
No
ACCESS CALLED PARTY'S CALENDAR BY CALLING NUMBER
237
CALENDAR ENTRIES WITHIN CALENDAR_LAG_TIME WITH CALLING NUMBER ?
239
Yes
No
PRIORITY PROCESSING = NO
241
PRIORITY PROCESSING = YES
235
RETURN

FIG. 8

METHOD AND SYSTEM FOR PRIORITY CALL PROCESSING

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is related to application Ser. No. 09/412,269, filed Oct. 5, 1999, titled PRIORITY CALL PRECESSING BASED ON PHONE MAIL MESSAGES, application Ser. No. 09/441,008, filed Nov. 16, 1999, titled METHOD AND SYSTEM FOR PRIORITY CALL PRECESSING BASED UPON ELECTRONIC CALENDAR STATUS, and application Ser. No. 09/466,024, filed Dec. 17, 1999, titled METHOD AND SYSTEM FOR PRIORITY CALL PRECESSING BASED UPON ELECTRONIC MAIL STATUS, the disclosure of each of which is incorporated herein by reference.

BACKGROUND

The present invention relates generally to the field of telephone and electronic office integration, and more particularly to a method of and system for providing priority call processing based upon voice mail, electronic calendar, and electronic mail status of a calling party or a called party.

Current telephone systems, implemented in circuit switched environments, such as the public switched telephone network (PSTN) or private branch exchange (PBX) networks, or in packet switched environments, such Internet protocol (IP) telephony systems, provide many options for enhancing the usefulness of the system to users. For example, voice mail enables users to have their calls answered by an automated system that records a voice message from the calling party if the called party is unavailable or desires not to take the call. Call forwarding allows a user to have calls to their number forwarded to another number. Call forwarding can be combined with voice mail so that a user can have calls forwarded automatically to voice mail. Certain telephone devices include a do not disturb (DND) key that is used to automatically forward calls to voice mail, a secretary, or a message center.

Voice mail and call forwarding thus enable a user not to be disturbed during meetings or during periods when the user wishes to work without being interrupted with telephone calls. However, there are times that a user would like to receive certain priority calls at the same time the user wishes not to be bothered with normal calls. For example, a user may have a meeting scheduled in the recent past or near future with another party and expect a call from that party regarding the meeting. Similarly, the user may have left an important voice mail message for another party and expect a call from that party. Additionally, the user may send a priority or urgent electronic mail item and expect a call from the recipient. Also, the user may simply wish to receive calls from certain callers or classes of callers at any time. In such cases, the user might wish not to receive most calls, but the user would certainly want to speak immediately to a priority party. Currently, the user must either receive all calls, or monitor his or her voice mail box for messages from the other party. If a caller ID display is available, the calling party must be calling from a recognized phone for the called party to be able to recognize the caller ID.

SUMMARY

The present invention provides a method of and system for providing special call processing based upon called party specified masks and the status of electronic mail, electronic calendar, and voice mail items associated with the called party and a calling party. Briefly stated, the system receives a request to set up a call between a calling party number and a called party number. The system determines if the called number is associated with a mask entry that matches the calling number. If so, the system provides special processing of the call based upon the matching mask entry. The mask entry may specified by digits and or wild card characters. Special processing is specified by a disposition code in the matching mask entry.

If the called number is not associated with a mask entry that matches calling number, the system determines if the called party has a call priority setting set to on for at least one of electronic mail, electronic calendar, or voice mail priority processing. If so, the system determines the status of the at least one electronic mail, electronic calendar, and voice mail between the called party and said calling party, and processes the call based upon the status.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a circuit switched network according to the present invention.

FIG. **2** is a block diagram of a packet switched network according to the present invention.

FIGS. **3**A and **3**B comprise a flowchart of voice mail administration processing according to the present invention.

FIGS. **4**A and **4**B comprise a flowchart of call processing according to the present invention.

FIGS. **5**A, **5**B, and **5**C comprise a flowchart of mask processing according to the present invention.

FIG. **6** is a flowchart of voice mail priority processing according to the present invention.

FIG. **7** is a flowchart of electronic mail priority processing according to the present invention.

FIG. **8** is a flowchart of calendar priority processing according to the present invention.

DETAILED DESCRIPTION

Referring now to the drawings, and first to FIG. **1**, a circuit switched embodiment of the present invention is designated generally by the numeral **11**. System **11** is implemented in a private telephone network that accesses the public switched telephone network (PSTN) **13** through a private branch exchange (PBX) switch **15**.

System **11** includes a plurality of telephone devices, including a calling party telephone **17** and a called party telephone **19**, connected to PBX **15**. Calling party telephone **17** and called party telephone **19** are each associated with a respective user identified by a telephone number or extension. According to the present invention, each user is also associated with a personal computer. Thus, a user of calling party telephone **17** is associated with a calling party personal computer **21**. Similarly, user of called party telephone **19** is associated with a called party personal computer **23**. Personal computers **21** and **23** for each identified by a network address and an electronic mail address associated with their respective users. According to the present invention, telephones **17** and **19** are interfaced to personal computers **21** and **23**, respectively, by a suitable communications interface, such as an M-WAVE (TM) or ROLM244 PC (TM) interface, in a manner well known to those skilled in the art.

The telephone portion of system **11** includes a voice mail platform **25** interfaced to PBX **15**, in the manner well known

to those skilled in the art. Voice mail platform **25** cooperates with PBX **15** to provide standard voice mail services as well as enhanced integrated telephone and electronic office services according to the present invention. Voice mail platform **25** includes an administrative interface that is preferably implemented in a voice response unit that enables users to administer their voice mail boxes in the manner well known to those skilled in the art. As will be explained in detail hereinafter, the administrative interface of voice mail platform **25** enables users of system **11** to administer call processing according to the present invention.

Personal computers **21** and **23** operate in local area network (LAN) environment **27**. LAN **27** is preferably interfaced to a wide area network or to the Internet (neither shown). LAN **27** includes an electronic mail server **29** and an address book server **31**. Electronic mail server **29** and address book server **31** provide standard electronic mail and address book services, respectively. Electronic mail server **29** and address book server **31** also provide services according to present invention PBX **17** through suitable application programming interfaces (APIs), as will be explained detail hereinafter.

LAN **27** also includes an electronic calendar server **33**. Electronic calendar server **33** provides standard electronic calendar services. Electronic calendar server **33** also provides services according to present invention PBX **15** through suitable application programming interfaces (APIs), as will be explained detail hereinafter.

Referring now to FIG. **2**, the present invention also operates in a packet switched telephone system such as an Internet protocol (IP) telephone network **41**. In network **41**, calls are set up using a signaling protocol such as session initiation protocol (SIP) or H.323 protocol. After setup, calls are transported across Internet **43** using a protocol such as real-time transport protocol (RTP), or the like. Calls can be made between calling parties and called parties across Internet **43** using Web phone enabled personal computers, such as personal computers **45** and **47**, and Internet phone devices, such as IP phone **49**. A call manager **51**, which in the preferred embodiment includes a SIP proxy server, provides services such as local number portability, call forwarding, quality of service, and other services during call setup. Network **41** is interfaced to public switched telephone networks **53** and **55** through IP telephony gateways **57** and **59**, respectively. Thus, calls can be made between IP telephony users and PSTN users.

In network **41**, such services as voice mail and electronic mail, address book, and calendar are provided by applications that reside on servers or personal computers. Voice mail and electronic mail, calendar, and address book applications may be implemented in a shared client-server environment, or they may be implemented as stand-alone applications on an individual personal computer. In any event, and as will be apparent to the skilled in the art, suitable APIs are provided according to present invention to integrate the voice mail and electronic mail, calendar, and address book functions.

Referring now to FIG. **3**, there is shown a flowchart of voice mail administration processing according to one embodiment of the present invention. The embodiment of FIG. **3** finds particular application in the circuit switched environment of FIG. **1**. The administration interface of the voice mail system provides a user interface by which the user can interact with the system of the present invention. In FIG. **3**, the user connects to the administration interface by telephone, as indicated at block **71**. As is well known to those skilled in the art, the user connects to the administration interface by dialing a particular number or extension. The administration interface includes a voice response unit that guides the user through audio menus.

After the user has connected to the administration interface, the system tests, at decision block **73**, if the current session is the user's first visit to the administrative interface. If so, the system sets a default delivery lag time, at block **75**. The system of the present invention treats, as priority, recently delivered voice mail and electronic mail items. According to the present invention, voice and electronic mail items delivered within the delivery lag time prior to the time that a particular call is initiated are considered recently delivered and deemed to be priority mail items. Also, if the user has not previously visited the administration interface, the system the system sets a default calendar lag time, at block **76**.

The system of the present invention, also treats, as priority, calendar events, such as meetings and conferences, involving the calling party and the called party that are scheduled to commence near the time of the call. More specifically, events scheduled later than a particular time prior to the call are deemed to be priority events. The particular time is defined by the calendar lag time. As will be explained, events later than the calendar lag time trigger priority call processing according to the present invention.

If, at decision block **73**, the user has previously visited the administration interface, the system clears out obsolete log items according to the relevant delivery lag time, at block **77**. According to the present invention, the voice mail and electronic mail logs are maintained. Thus, delivery lag time is managed with respect to the electronic mail and voice mail logs.

After clearing out obsolete log items, at block **77**, the user navigates through the interface, as indicated generally at block **78**. During navigation, the user is presented with prompts to enter responses to menu items. Typically, a user can exit or quit the administration interface by entering a termination request or by hanging up. If, at decision block **79**, the system determines the user has elected to quit, the administrative interface is terminated, at block **81**, and FIG. **3** processing ends.

If, at decision block **83**, it is determined the user wants to modify voice mail priority handling, the user is prompted to specify ON or OFF for voice mail priority call handling, at block **85**. As will be explained in detail hereinafter, if the user specifies ON for priority handling, then calls will receive priority processing according to present invention. If the user specifies OFF, then calls will be processed normally. In similar fashion, if at decision block **87** it is determined the user entered a DTMF signal indicating the user's desire to modify electronic mail priority handling, the user is prompted to specify ON or OFF for electronic mail priority call handling, at block **89**. Finally, if at decision block **91** it is determined the user entered the user's desire to modify electronic calendar priority handling, the user is prompted to specify ON or OFF for electronic calendar priority call handling, at block **93**.

According to the present invention, a user can modify the e-mail delivery or calendar lag times. If, at decision block **95**, it is determined that the user entered the user's desire to modify delivery lag time, the system prompts the user to enter a delivery lag time, at block **97**. For example, the user may be prompted to enter digits corresponding to a number of days and/or hours. Similarly, if at decision block **99** it is determined that the user entered the user's desire to modify

calendar lag time, the system prompts the user to enter a calendar lag time, at block **101**. Again, the user may be prompted to enter digits corresponding to a number of days and/or hours.

In addition to call priority processing based upon voice mail and electronic mail or calendar status, the present invention enables call priority processing based upon the identity of a caller or a class of callers. The present invention allows a user to define a mask table containing caller ID masks that are compared to incoming caller IDs for the purpose of determining priority. Additionally, according to the present invention, the user is able to use wild card characters to broaden the class of caller IDs that will satisfy a predicate. For example, a user may specify the following mask predicates:

56#9 All extensions with 56X9, where X is any digit;

214-* All callers in the 214 area code; or

609-234-* All callers in the 609 area code and the 234 service area.

Moreover, according to the present invention, a user may specify how to process a call that matches a particular mask entry. For example, a user can create a mask entry for his home phone number, thereby making calls from home priority calls. However, the user may wish to limit priority processing of calls from home. In the preferred embodiment, at least the following enumerations of priority handling types are defined:

1=Call invokes call waiting processing if busy, and call rings called number if forwarded and not busy;

2=Call rings called number if not busy, and call forwards to voice mail if busy;

3=Call forwards to voice mail;

4=Call forwards to specified number (Forwarding numbers are then searched in the mask table for corresponding priority processing. Thus, the mask table is continually searched for each forwarded number until a priority setting other than 4 is found or there is no match in the table for the currently searched number.);

5=Call provides busy signal processing to the calling party.

Thus, referring to FIG. **3B**, if at decision block **103** it is determined that the user entered DTMF signals indicating the user's desire to modify a number predicate, the user is prompted to annotate current configurations (i.e. mask entries) with a disposition enumeration, add a configuration entry, or delete a configuration entry. If, at decision block **105**, it is determined that the user has chosen to annotate current configurations, the user is prompted to sequentially annotate mask entries with assigned enumeration values, at block **107**. The system tests, at decision block **109**, if all entries have been annotated or the user has exited annotation. If not, processing continues at block **107**. If, at decision block **109**, all entries have been annotated or the user has exited annotation, then processing continues at block **78** of FIG. **3A**.

If, at decision block **111**, it is determined that the user has chosen to add a configuration entry, the system prompts the user to specify a caller ID mask at block **113**, in the manner described above. Then, the system prompts the user to enable or disable priority at block **115**. Then, the system adds the mask configuration to the mask table, at block **117**, and processing continues at block **78** of FIG. **3A**. If, at decision block **119**, it is determined that the user has chosen to delete a configuration entry, the system prompts the user to specify a correlation enumeration, at block **121**, and the system deletes the specified mask configuration from the mask table, at block **123**. Then, processing continues at block **78** of FIG. **3A**. If, as determined at decision block **103**, the user does not choose to modify a number predicate, the user may perform other administration functions that are typical in currently existing voice mail systems, as indicated at block **125**. FIG. **3** processing continues until the user quits at decision block **79**.

Referring now to FIG. **4**, there is shown a flowchart of call processing according to the present invention. The present invention may be implemented in connection with a terminating switch or terminating PBX, in a circuit switched telephony environment, or in connection with a terminating personal computer in an IP telephony environment. When a call is received, the terminating switch, PBX, or personal computer determines the called number, at block **127**. According to the present invention, the system clears out obsolete log items according to the delivery lag time, at block **129**. Then, the system accesses the call party's priority settings, at block **131**. If, at decision block **133**, the called party has mask table entries, then the system performs mask processing, as indicated generally at block **135** and shown in detail in FIG. **5**.

Referring now to FIG. **5**, the system sets the number equal to the called number, at block **137**. Then the system access the mask table by number, at block **139**. If, at decision block **141**, the number is found, the system gets the first or next mask table entry for the number, at block **143**. The system tests, at decision block **145**, if all mask entries for the number have been searched. If so, the system tests, at decision block **147**, if at least one forwarded number has been produced. If so, the system provides normal call forwarding processing, at block **149**, and processing returns to FIG. **4A**. If, at decision block **147**, at least one forwarded number has not been produced, then processing returns to FIG. **4A**.

Referring again to decision block **145**, if all mask table entries for the number have not been searched, the system tests, at decision block **151**, if the caller ID number satisfies the current mask table entry. If not, processing continues at block **143**. Processing loops through the mask table entries for the number until either the caller ID number satisfies the current mask table entry, at decision block **151**, or all mask table entries for the number have been searched, at decision block **145**.

If, at decision block **151**, the caller ID number satisfies the current mask entry, then the system determines the type of call processing for the call, based upon the disposition code associated with the mask entry. If, at decision block **153**, the current mask entry specifies disposition code **1**, which invokes call waiting processing if busy and rings called number if forwarded and not busy, processing proceeds to FIG. **5C**. The system tests, at decision block **155**, if the called number is forwarded. If so, the system overrides call forwarding and rings the called number a specified number of rings as though not forwarded, at block **157**. If, at decision block **159**, the called number is answered with the specified number of rings, the call proceeds, as indicated at block **161**. If, at decision block **159**, the called number is not answered with the specified number of rings, the system forwards the call as originally indicated, at block **161**.

Returning to decision block **155**, if the called number is not forwarded, then the system tests, at decision block **165**, if the called number is busy. If so, the system performs priority call waiting, at block **167**. If so, the system provides priority tones, at block **141**, and performs call waiting functionality, at block **143**. Priority call waiting according to the preferred embodiment includes providing priority tones,

which comprise a signal or announcement to the called party that a priority call is waiting. The system performs call waiting functionality so that the called party can answer the priority call. If, at decision block **165**, the number is not busy, the call takes place in the usual manner, as indicated at block **169**.

Referring again to decision block **153** of FIG. **5A**, the disposition code does not equal 1, then processing proceeds to FIG. **5B**. The system tests, decision block **171** if the disposition code to the mask entry is 2. If, at decision block **173**, the called number is not busy, then the system rings the called number, at block **175**. If the called number is busy, then the system forwards the call to voice mail, at block **177**. If, at decision block **179**, the disposition code of the mask entry is equal to 3, the system routes the call to voice mail, as indicated block **181**, even if the called number is forwarded to an other number or not busy. If, at decision block **183**, the disposition code of the mask entry is 4, then the system sets the number (see block **137** of FIG. **5A**) equal to the forwarding number, at block **185**, and processing proceeds back to block **139** of FIG. **5A**. According to the present invention, forwarding numbers are searched in the mask table for corresponding priority processing. Thus, the mask table is continually searched for each forwarded number until at a priority setting other than 4 is found or there is no match in the table for the currently searched number. If, at decision block **187**, the disposition code for the mask entry is 5, then the system performs busy signal processing, as indicated at block **189**. At the completion of processing according to FIG. **5**, processing returns to FIG. **4**.

Referring again to FIG. **4A**, the system performs priority call processing according to voice mail, electronic mail, and calendar status. It will be recalled that a priority setting is either ON or OFF. If, at decision block **191**, the called party's voice mail priority setting is ON, the system performs voice mail priority processing, as indicated generally at block **193** and shown in detail with respect to FIG. **6**. Referring to FIG. **6**, the system accesses the calling party's voice mail, at block **195**. Voice mail priority events according to the present invention generally include voice mail messages left for the calling party by the called party that require a response. The system tests, at decision block **197**, if the calling party's voice mail box includes a voice mail message from the called party. If so, priority processing is set to YES, at block **199**, and processing returns to FIG. **4A**. If not, then the system tests, at decision block **201**, if the calling party has listened to a voice mail message from the calling party within the delivery lag time. If so, priority processing is set to YES, at block **199**, and processing returns to FIG. **4A**. If not, then the system tests, at decision block **203**, if the calling party has an archived voice mail message from the calling party. If so, priority processing is set to YES, at block **199**, and processing returns to FIG. **4A**. If not, priority processing is set to NO at block **205**, and processing returns to FIG. **4A**.

Referring again to FIG. **4A**, the system tests, at decision block **207**, if priority processing is set to YES. If so, processing continues to FIG. **4B**. If not, the system tests, at decision block **209**, if electronic mail priority is set to ON. If so, processing proceeds to FIG. **7**, as indicated generally at block **211**.

Referring now to FIG. **7**, there is shown a flowchart of call processing based upon electronic mail status between the calling party and the called party according to the present invention. The system tests, at decision block **213**, if a log item exists for calling party, the system sets priority processing to YES, at block **215**, and processing returns to FIG. **4A**. A log item exits if the called party has answered a confirm on delivery (COD) electronic mail item from the called party within the delivery lag time. If, at decision block **213**, a log item does not exist from the calling party, then the system accesses the called party's unanswered outbound COD mail items, at block **217**. Then, the system tests, at decision block **219**, if there are any unanswered COD electronic mail items from the called party to the calling party. If so, the system set priority processing to YES, at block **215**, and processing returns to FIG. **4A**. If, at decision block **219**, there are no unanswered COD items, then the system accesses the called party's priority repository or repositories and tests, at decision block **221**, if the repository contains any electronic mail items to or from the calling party. A priority repository is a folder or the like into which a user places priority electronic mail items. If so, the system sets priority processing to YES, at block **215**, and processing returns to FIG. **4A**. If not, the system sets priority processing to NO, at block **223**, and processing returns to FIG. **4A**.

Referring again to FIG. **4A**, the system tests, at decision block **225**, if priority processing is set to YES. If so, processing continues to FIG. **4B**. If not, the system tests, at decision block **227**, if electronic calendar priority is set to ON. If so, processing proceeds to FIG. **8**, as indicated generally at block **229**.

Referring to FIG. **8**, the system accesses the calling party's electronic calendar by the called party's telephone number or extension, at block **231**. Then, the system tests, at decision block **233**, if there are any calendar entries within the calendar lag time that include the called number. If so, the system sets priority processing to YES, at block **235**, and returns to FIG. **4A**. If, at decision block **233**, there are no calendar entries within the calendar lag time that include the called number, then the system accesses the called party's calendar by calling party number, at block **237**. Then the system tests, at decision block **239**, if there are any calendar entries within the calendar lag time that include the calling number. If so, the system sets priority processing to YES, at block **235** and returns to FIG. **4A**. If not, the system sets priority processing to NO, at block **241** and returns to FIG. **4A**.

Referring again to FIG. **4A**, the system tests, at decision block **243**, if priority processing is set to YES. If so, processing continues to FIG. **4B**. If not, the system performs other call handling at block **245** and FIG. **4** processing ends.

Referring now to FIG. **4B**, during priority call processing, the system tests, at decision block **247**, if the called number is off hook or busy. If so, the system provides priority tones, at block **249**, and performs call waiting functionality, at block **251**. Again, priority tones comprise a signal or announcement to the called party that a priority call is waiting. The system performs call waiting functionality so that the called party can answer the priority call.

If, at decision block **247**, the called number is on hook, the system tests, at decision block **253**, if the called number is forwarded. If so, the system overrides call forwarding by ringing the called number as though the number were not forwarded, at block **255**. Typically, a user invokes call forwarding either to avoid receiving non-priority calls or to receive calls at another location. Since it is not known what motivated the called party to invoke call forwarding, the system rings the called number only a specified limited number of times. If, at decision block **257**, the phone does not go off hook within the specified number of rings, the system forwards the call as indicated, at block **259**. If the called party answers the call within the specified number of rings, the call proceeds normally, as indicated at block **261**.

Referring back to decision block **253**, if the called number is not forwarded, then the system performs normal ringing and subsequent processing, as indicated at block **263**.

From the foregoing, it may be seen that the present invention is well adapted to overcome the shortcomings of the prior art. The present invention provides greater flexibility in allowing a user to receive priority calls while using features, such as voice mail and call forwarding, to avoid answering non-priority calls, and while he or she is on a call to another party. The present invention is applicable to both circuit switched telephone systems and packet switched telephone systems.

What is claimed is:

1. A method of processing a call between a calling number and a called number, which comprises the steps of:

determining if said called number is associated with a mask entry that matches said calling number;

if said called number is associated with the mask entry, providing special processing of said call based upon said matching mask entry; and

if said called number is not associated with the mask entry, processing said call based upon status of an electronic mail, according to a call priority setting,

wherein, status of the electronic mail includes existence of an electronic mail item in a priority repository of said called party.

2. The method as claimed in claim **1**, wherein said mask entry is specified by digits.

3. The method as claimed in claim **1**, wherein said mask entry is specified by digits and at least one wild card character.

4. The method as claimed in claim **3**, wherein said wild card character specifies a single digit position in a calling number.

5. The method as claimed in claim **3**, wherein said wild card character specifies a group of digits in a calling number.

6. The method as claimed in claim **1**, wherein said mask entry includes a disposition code, and said step of providing special processing includes the step of processing said call based upon said disposition code.

7. The method as claimed in claim **1**, wherein said electronic mail item includes a priority electronic mail item.

8. The method as claimed in claim **7**, wherein said priority electronic mail item is a confirm on delivery mail item from said called party to said calling party.

9. The method as claimed in claim **7**, wherein said priority electronic mail item is a confirm on delivery mail item from said called party to said calling party delivered within a set time period prior to receipt of said request to set up said call.

10. The method as claimed in claim **9**, wherein said time period is set by said called party.

11. The method as claimed in claim **7**, wherein said priority electronic mail item is an unanswered confirm on delivery electronic mail item from said called party to said calling party.

12. The method as claimed in claim **1**, wherein said step of processing of said call based upon said status includes the step of:

waiting said call if said called patty telephone device is busy.

13. The method as claimed in claim **12**, including the step of:

providing a special notification to said called party that a priority call is waiting.

14. The method as claimed in claim **1**, wherein said step of providing special processing includes the step of:

overriding call forwarding.

15. The method as claimed in claim **14**, wherein said step of overriding call forwarding includes the step of:

ringing the number of said called party if said called number is forwarded to a second number.

16. The method as claimed in claim **15**, including the step of:

forwarding said call to said second number if the telephone device associated with said called party number is not answered within a selected number of rings.

17. The method as claimed in claim **15**, wherein said ringing step includes the step of:

providing a special priority ringing tone.

18. A system for processing a call between a calling number and a called number, said system configured to perform the method as claimed in claim **1**.

19. The method as claimed in claim **1**, further comprising:

selectively processing said call based upon status of voice mail according to the call priority setting associated with the voice mail.

20. The method as claimed in claim **19**, wherein said voice mail status include the existence of a voice mail message from said called party to said calling party.

* * * * *

US006751652B1

(12) **United States Patent**
Thomas

(10) **Patent No.: US 6,751,652 B1**
(45) **Date of Patent: Jun. 15, 2004**

(54) **INTELLIGENT END USER DEVICES FOR CLEARINGHOUSE SERVICES IN AN INTERNET TELEPHONY SYSTEM**

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(73) Assignee: **TransNexus, Inc.**, Atlanta, GA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 595 days.

(21) Appl. No.: **09/606,574**

(22) Filed: **Jun. 29, 2000**

Related U.S. Application Data

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(51) **Int. Cl.**[7] **G06F 15/16**

(52) **U.S. Cl.** **709/204**; 709/225; 709/226; 709/227; 709/229

(58) **Field of Search** 709/200, 217, 709/218, 219, 238, 242, 244, 245, 204, 225, 226, 227, 229

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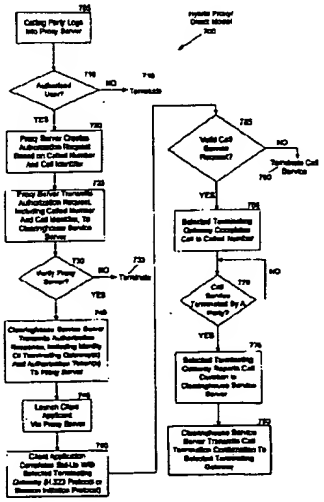
Primary Examiner—Saleh Najjar
(74) *Attorney, Agent, or Firm*—King & Spalding LLP

(57) **ABSTRACT**

Clearinghouse services architectures that support the use of end user devices, such as personal computers, Internet Protocol (IP) phones, cable multimedia terminal adapters, and residential gateways, in an Internet telephony system. The innovative architectures include a proxy-based system model, a direct communication model, and a hybrid proxy/direct communication model. A user can operate an "intelligent" end user device. i.e., a device running a client program with knowledge of the architecture particulars, to access a clearinghouse service on an IP network. This enables the user to communicate a telephony call over the IP network and via the combination of a terminating gateway identified by the clearinghouse service and the Public Switched Telephone Network.

20 Claims, 7 Drawing Sheets



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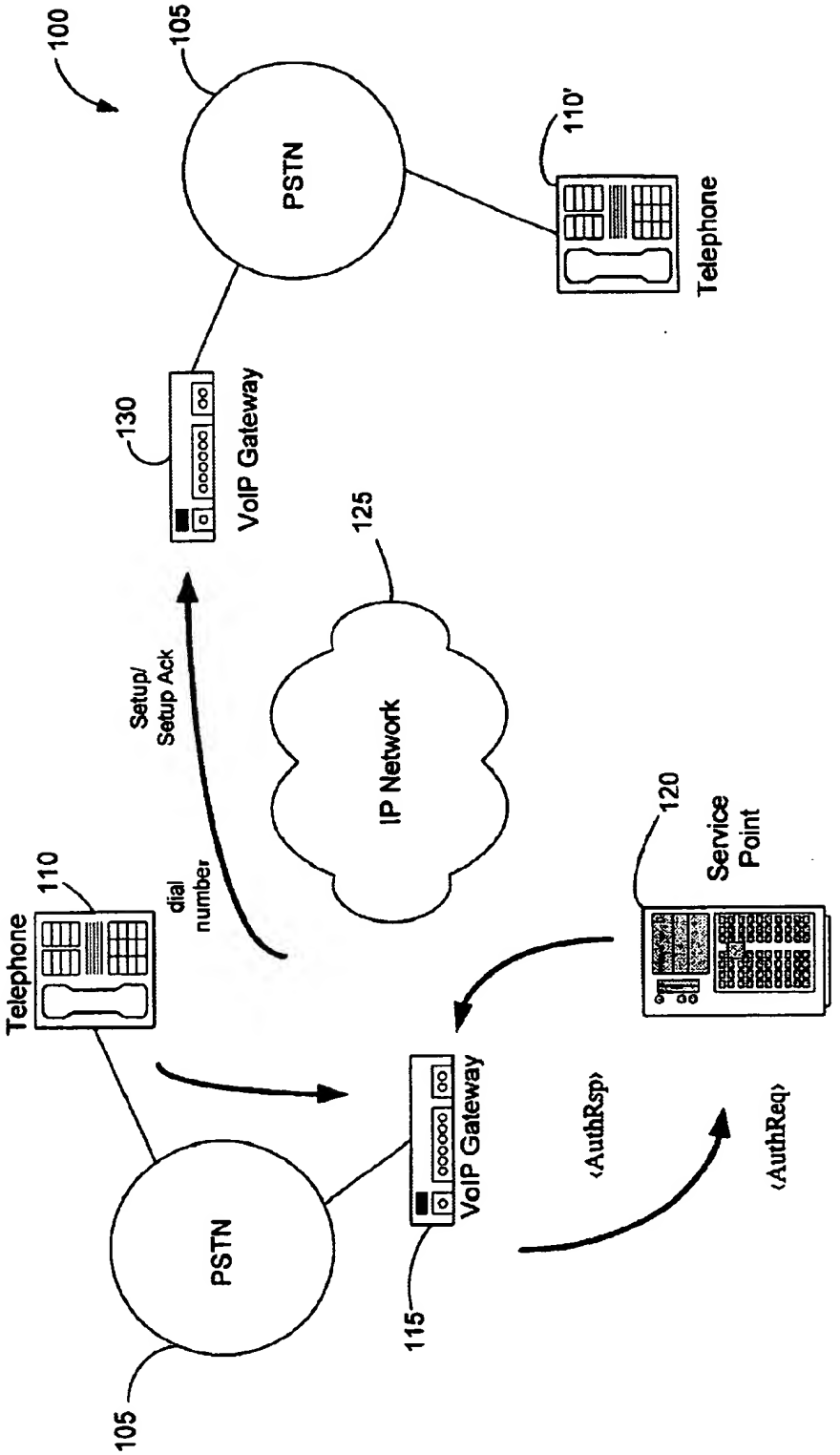
100
105
PSTN
110'
Telephone
130
VoIP Gateway
125
IP Network
Setup/
Setup Ack
dial
number
110
Telephone
120
Service
Point
PSTN
105
VoIP Gateway
115
‹AuthRsp›
‹AuthReq›

Fig. 1

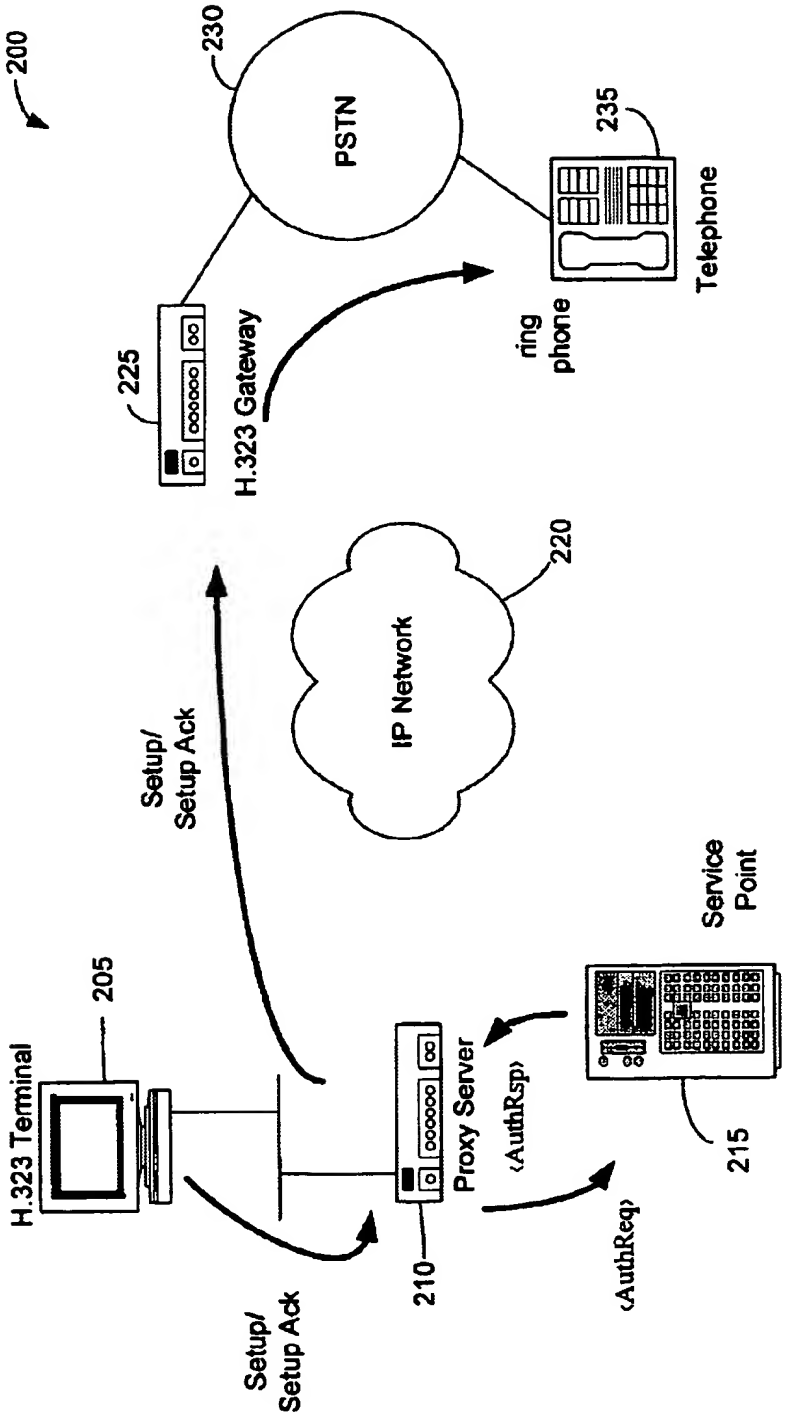
200
230
PSTN
235
Telephone
225
H.323 Gateway
ring phone
220
IP Network
Setup/ Setup Ack
Service Point
205
H.323 Terminal
Proxy Server
(AuthRsp)
(AuthReq)
215
210
Setup/ Setup Ack

Fig. 2

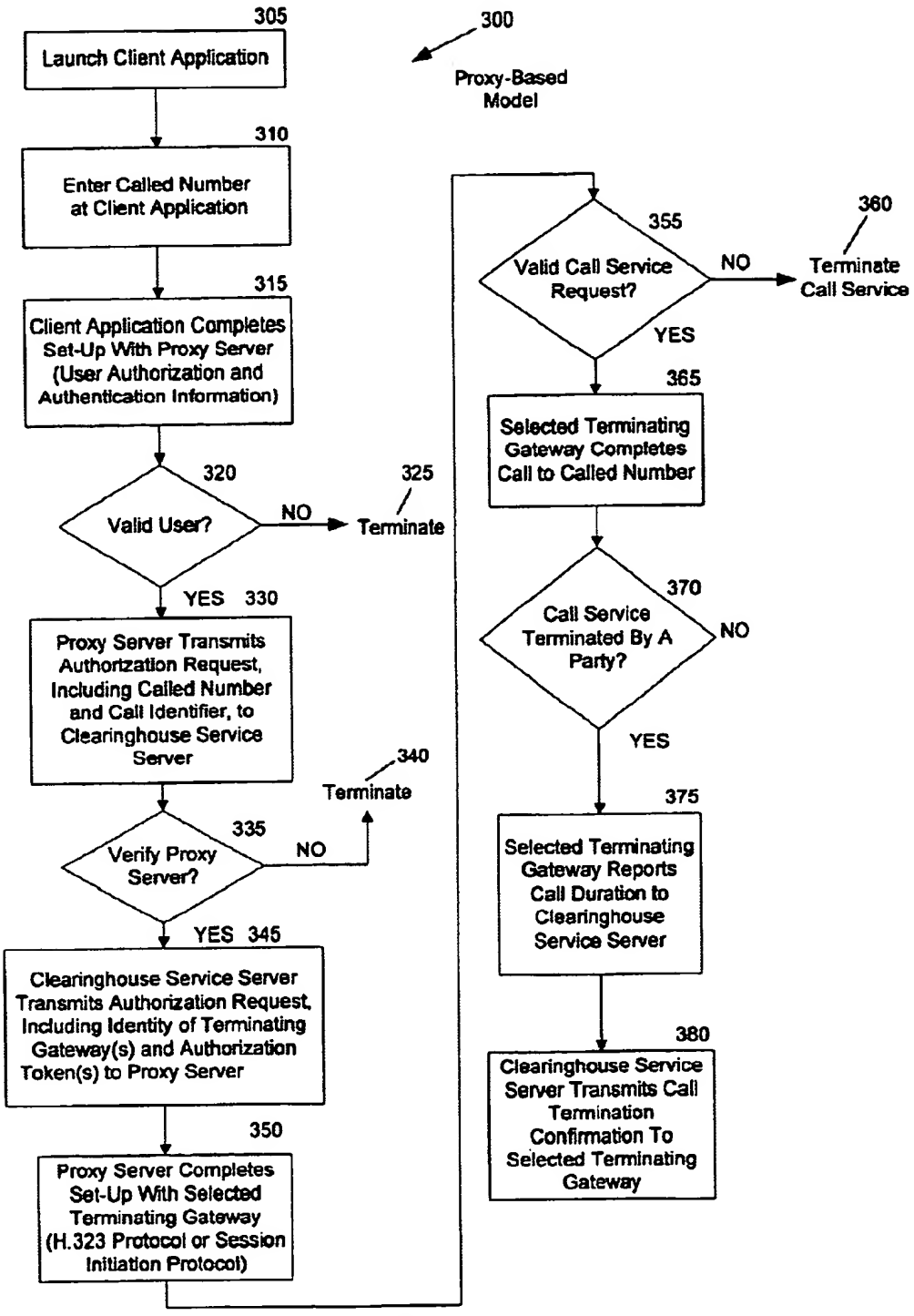
300
Proxy-Based Model
305
Launch Client Application
310
Enter Called Number at Client Application
315
Client Application Completes Set-Up With Proxy Server (User Authorization and Authentication Information)
320
Valid User?
NO
325
Terminate
YES 330
Proxy Server Transmits Authorization Request, Including Called Number and Call Identifier, to Clearinghouse Service Server
340
Terminate
335
Verify Proxy Server?
NO
YES 345
Clearinghouse Service Server Transmits Authorization Request, Including Identity of Terminating Gateway(s) and Authorization Token(s) to Proxy Server
350
Proxy Server Completes Set-Up With Selected Terminating Gateway (H.323 Protocol or Session Initiation Protocol)
355
Valid Call Service Request?
NO
360
Terminate Call Service
YES
365
Selected Terminating Gateway Completes Call to Called Number
370
Call Service Terminated By A Party?
NO
YES
375
Selected Terminating Gateway Reports Call Duration to Clearinghouse Service Server
380
Clearinghouse Service Server Transmits Call Termination Confirmation To Selected Terminating Gateway

Fig. 3

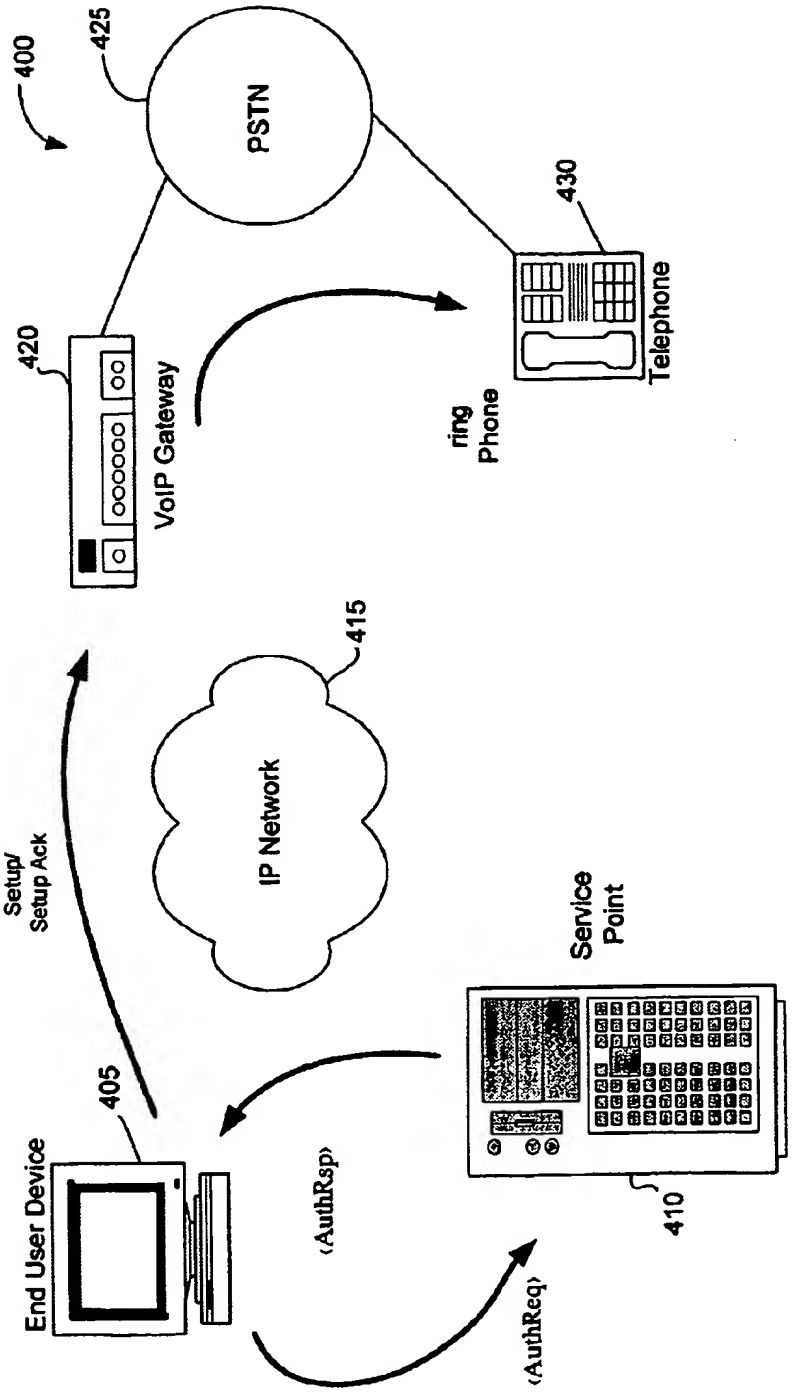
400
425
PSTN
430
Telephone
420
VoIP Gateway
ring
Phone
415
IP Network
Setup/
Setup Ack
Service
Point
405
End User Device
⟨AuthRsp⟩
410
⟨AuthReq⟩

Fig. 4

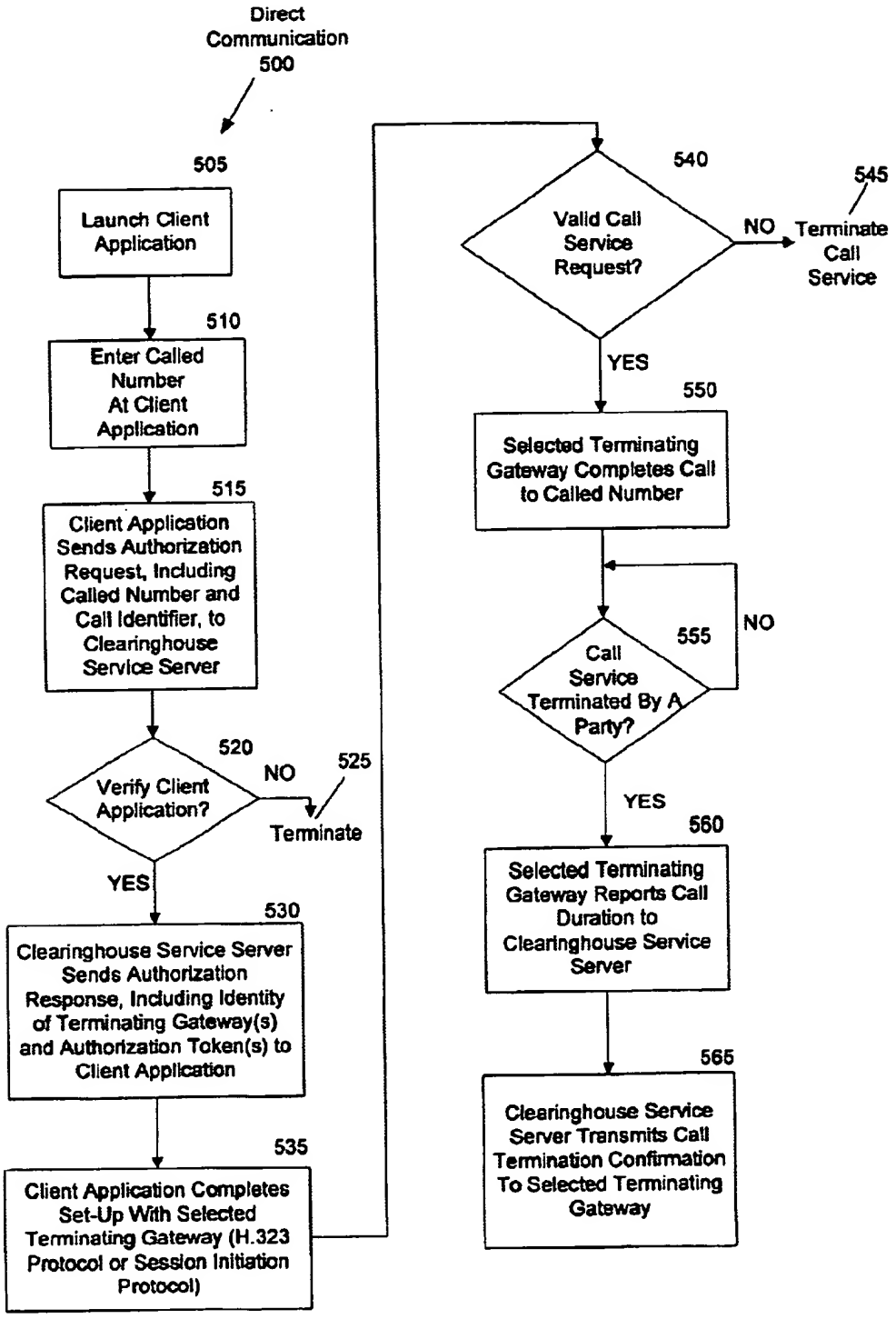
Direct Communication
500
505
Launch Client Application
510
Enter Called Number At Client Application
515
Client Application Sends Authorization Request, Including Called Number and Call Identifier, to Clearinghouse Service Server
520
Verify Client Application?
NO
525
Terminate
YES
530
Clearinghouse Service Server Sends Authorization Response, Including Identity of Terminating Gateway(s) and Authorization Token(s) to Client Application
535
Client Application Completes Set-Up With Selected Terminating Gateway (H.323 Protocol or Session Initiation Protocol)
540
Valid Call Service Request?
NO
545
Terminate Call Service
YES
550
Selected Terminating Gateway Completes Call to Called Number
555
Call Service Terminated By A Party?
NO
YES
560
Selected Terminating Gateway Reports Call Duration to Clearinghouse Service Server
565
Clearinghouse Service Server Transmits Call Termination Confirmation To Selected Terminating Gateway

Fig. 5

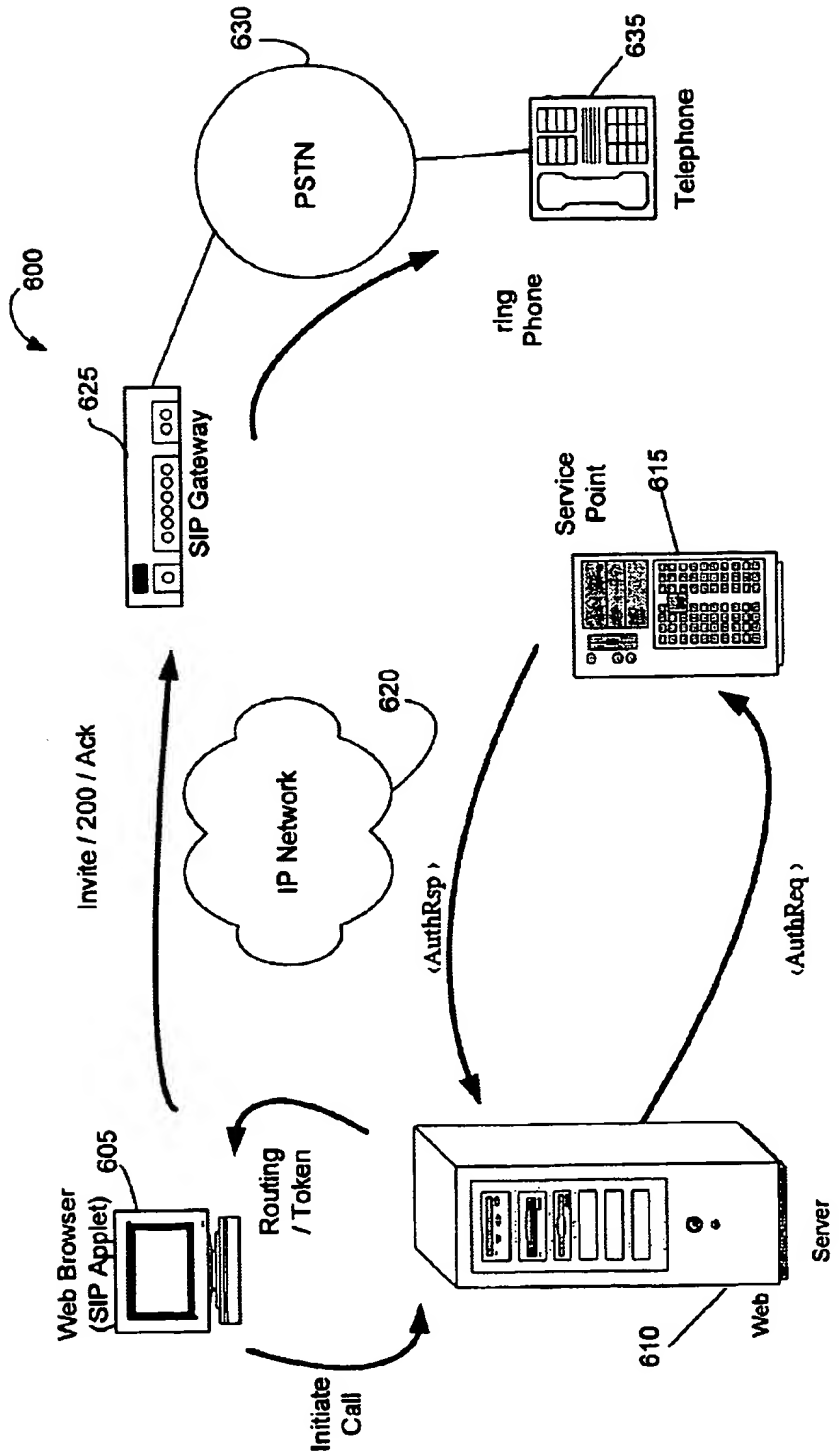
800
630
PSTN
635
Telephone
ring Phone
625
SIP Gateway
Service Point
615
620
IP Network
Invite / 200 / Ack
⟨AuthRsp⟩
⟨AuthReq⟩
605
Web Browser (SIP Applet)
Routing / Token
Initiate Call
610
Web Server

FIG. 6

Fig. 6

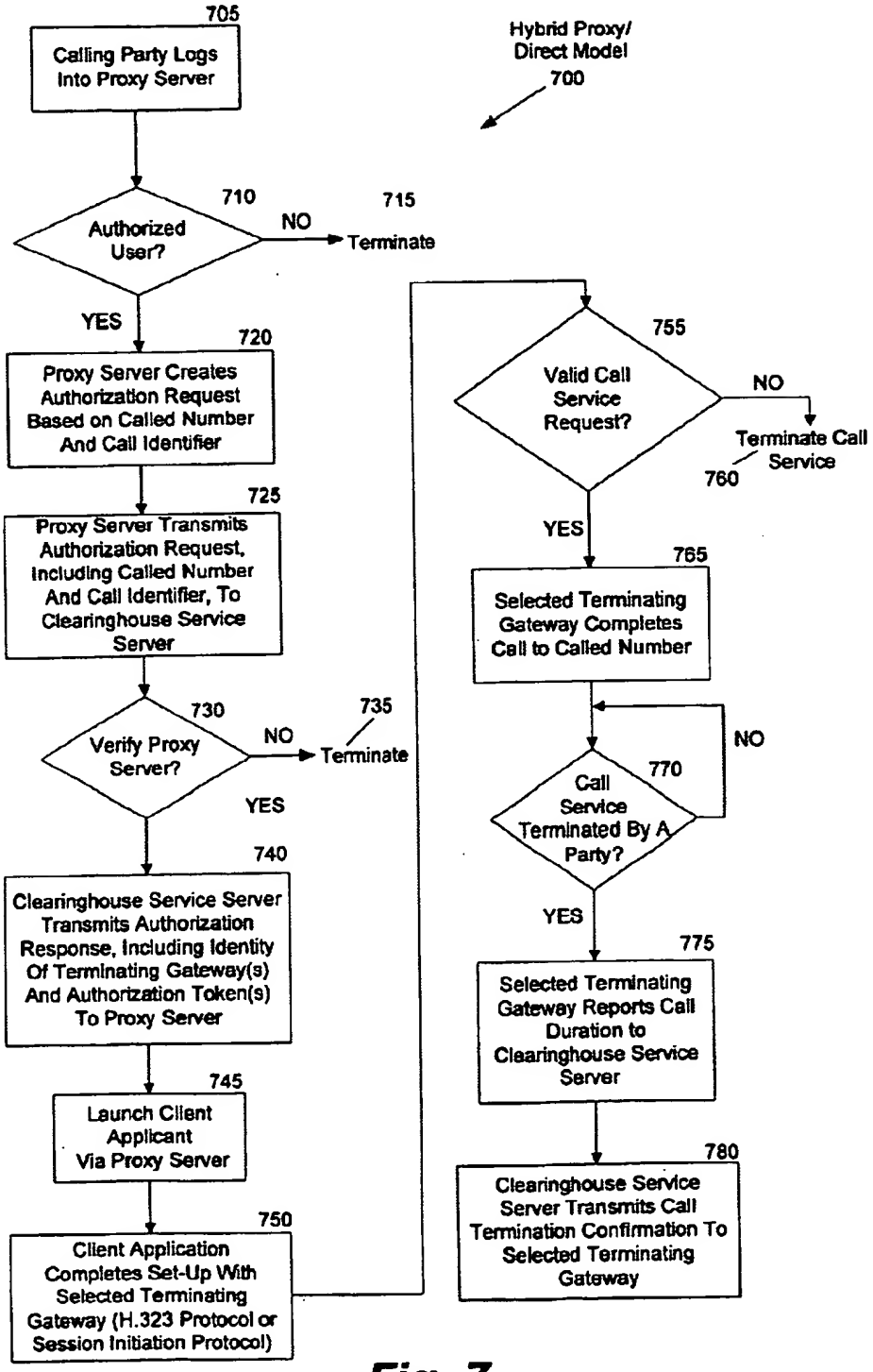
Hybrid Proxy/ Direct Model
700
705
Calling Party Logs Into Proxy Server
710
Authorized User?
NO
715
Terminate
YES
720
Proxy Server Creates Authorization Request Based on Called Number And Call Identifier
725
Proxy Server Transmits Authorization Request, Including Called Number And Call Identifier, To Clearinghouse Service Server
730
Verify Proxy Server?
NO
735
Terminate
YES
740
Clearinghouse Service Server Transmits Authorization Response, Including Identity Of Terminating Gateway(s) And Authorization Token(s) To Proxy Server
745
Launch Client Applicant Via Proxy Server
750
Client Application Completes Set-Up With Selected Terminating Gateway (H.323 Protocol or Session Initiation Protocol)
755
Valid Call Service Request?
NO
760
Terminate Call Service
YES
765
Selected Terminating Gateway Completes Call to Called Number
770
Call Service Terminated By A Party?
NO
YES
775
Selected Terminating Gateway Reports Call Duration to Clearinghouse Service Server
780
Clearinghouse Service Server Transmits Call Termination Confirmation To Selected Terminating Gateway

Fig. 7

INTELLIGENT END USER DEVICES FOR CLEARINGHOUSE SERVICES IN AN INTERNET TELEPHONY SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority to U.S. Provisional Application No. 60/141,432 filed Jun. 29, 1999.

FIELD OF THE INVENTION

The present invention is generally directed to intelligent end user devices for use with a clearinghouse service in an Internet telephony system. More specifically described, the present invention is directed to proxy-based, direct communication, and hybrid proxy/direct model architectures for clearinghouse services in an Internet telephony system supporting communications with intelligent end user devices.

BACKGROUND OF THE INVENTION

Internet telephony clearinghouse services have been designed and developed for telephony services (voice and facsimile) delivered by gateways—devices that bridge Public Switched Telephone Network (PSTN) and Internet Protocol (IP) networks. A typical call scenario is supported by the clearinghouse services architecture **100** of FIG. **1**. A calling party communicates with an origination gateway **115** via a telephone handset **110** connected to the PSTN **105**. The origination gateway **115** uses clearinghouse services at a service point **120** coupled to an IP network **125** to identify and obtain call authorization for one or more termination gateways **130**. The origination gateway **115** can select one of the identified termination gateways **130** to accept the call communication from the calling party via the IP network **125**. One of the identified termination gateways **130** can complete the call communication to the called party at the handset **110'** via the PSTN **105**.

A key characteristic of this architecture is that all access to the clearinghouse services relies on gateways. Gateway operators are the sole users of clearinghouse services; existing services are not visible to, or directly accessible by, end users.

There is a need to extend the clearinghouse architecture to support intelligent end user devices, such as personal computers, IP phones, cable multimedia terminal adapters, and residential gateways. A critical factor in such an expansion is ensuring that the resulting architecture is interoperable with existing clearinghouse services. That will give users of these devices access to existing networks for termination of their calls, and it will provide additional sources of traffic to existing networks.

SUMMARY OF THE INVENTION

Three different architectures can accommodate the addition of intelligent end user devices into clearinghouse service networks for an Internet telephony system—proxy-based services, direct communication, and a hybrid proxy/direct communication model.

The present invention provides a proxy-based system for supporting clearinghouse services for a client device in an Internet Protocol (IP) telephony system. The IP telephony system includes at least one client device, a proxy system, such as a proxy server, a service point supporting a clearinghouse service and one or more terminating gateways. Each component is coupled to an IP network, such as the

global Internet. To initiate a call communication to a called party, a client application residing at the client device sends a call set-up request to a proxy server. The call set-up request typically comprises a called number for the call communication and user authentication information.

If the client application is a valid user of the services maintained at the proxy server, the proxy server transmits an authorization request to the clearinghouse service running on the service point. The authorization request typically comprises the called number and a call identifier assigned by the proxy server to the call communication.

If the proxy server is a valid user of the clearinghouse services, the service point transmits an authorization response to the proxy server via the IP network. The authorization response typically comprises the identity of one or more terminating gateways coupled to the IP network and available to deliver the call communication. This authorization response may also include an authorization token for each identified terminating gateway.

In response to the authorization response, the proxy server can select one of the terminating gateways to deliver the call communication. In turn, the proxy server transmits a call communication set-up request to the selected terminating gateway via the IP network. This set-up request typically comprises the called number, the call identifier, and the authorization token. If the proxy server is a valid user of the call delivery services of the selected terminating gateway, the selected terminating gateway completes call set-up operations and delivers the call communication to the Public Switched Telephone Network (PSTN).

The present invention provides a direct communication model for supporting clearinghouse services for a client device in an IP telephony system. The IP telephony system includes at least one client device executing an intelligent application program, a service point supporting a clearinghouse service and one or more terminating gateways. Each component is coupled to an IP network, such as the global Internet. The user can initiate a call via the client device by entering a telephone number to be called into the client program. In response, the client program can automatically initiate a communication with the clearinghouse service operating at the service point. For example, the client application can transmit an authorization request for a call communication to the clearinghouse service. The authorization request typically comprises a called number for the call communication and a call identifier assigned to the call communication.

If the client application is a valid user of the clearinghouse services, the service point transmits an authorization response to the client application via the IP network. The authorization response typically comprises (1) the identity of one or more terminating gateways coupled to the IP network and available to deliver the call communication and (2) an authorization token for each identified terminating gateway. In response, the client application can select one of the terminating gateways to deliver the call communication. Based on this selection of a terminating gateway, the client application prepares a call communication set-up request and transmits that request to the selected terminating gateway via the IP network. The set-up request typically comprises the called number, the call identifier, and the authorization token. If the client application is a valid user of the call delivery services of the selected terminating gateway, the gateway will deliver the call communication via the PSTN to the called number.

The present invention provides a hybrid proxy/direct communication model for supporting clearinghouse services

for a client device in an IP telephony system. The IP telephony system includes at least one Web-enabled client device, a proxy system, such as a proxy server, a service point supporting a clearinghouse service and one or more terminating gateways. Each component is coupled to an IP network, such as the global Internet. To initiate a call communication, a client application running on the Web-enabled client device transmits a call set-up request to a proxy server. The call set-up request typically comprises a called number for the call communication and user authentication information.

If the client application is a valid user of the services maintained at the proxy server, then the proxy server transmits an authorization request to the clearinghouse service running on the service point. The authorization request typically comprises the called number and a call identifier assigned to the call communication. If the proxy server is a valid user of the clearinghouse services, the service point transmits an authorization response to the proxy server via the IP network. The authorization response typically comprises (1) the identity of one or more terminating gateways coupled to the IP network and available to deliver the call communication and (2) an authorization token for each identified terminating gateway.

In response to the authorization response, the proxy server can route the identity of each terminating gateway and each authorization token to the client application via the IP network. In turn, the client application can select one of the identified terminating gateways to support the completion of the call communication. Based on this selection of a terminating gateway, the client application sends a call communication set-up request to the selected terminating gateway via the IP network. The set-up request typically comprises the called number, the call identifier, and the authorization token. If the client application is a valid user of the call delivery services of the selected terminating gateway, the selected terminating gateway delivers the call communication to the called number via the PSTN.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram illustrating a clearinghouse service architecture for an Internet telephony system including origination and termination gateways coupled to an Internet Protocol (IP) and the Public Switched Telephone Network (PSTN).

FIG. **2** is a block diagram illustrating a proxy-based architecture for a clearinghouse service in an IP telephony system constructed in accordance with an exemplary embodiment of the present invention.

FIG. **3** is a logical flow chart diagram illustrating the computer-implemented steps of a proxy-based process for an IP telephony system in accordance with an exemplary embodiment of the present invention.

FIG. **4** is a block diagram illustrating a direct communication architecture for a clearinghouse service in an IP telephony system constructed in accordance with exemplary embodiment of the present invention.

FIG. **5** is a logical flow chart diagram illustrating the computer-implemented steps of a direct communication process for a clearinghouse service for an IP telephony system in accordance with exemplary embodiment of the present invention.

FIG. **6** is a block diagram illustrating a hybrid proxy/direct architecture for a clearinghouse service in an IP telephony system constructed in accordance with an exemplary embodiment of the present invention.

FIG. **7** a logical flow chart diagram illustrating the computer-implemented steps for a hybrid proxy/direct communication process for a clearinghouse service in an IP telephony system in accordance with an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

The present invention provides clearinghouse services architectures that support the use of intelligent end user devices, such as personal computers, Internet Protocol (IP) phones, cable multimedia terminal adapters, and residential gateways, in an Internet telephony system. By the use of the present invention, a user can operate an intelligent end user device to access a clearinghouse service on an existing IP network. This enables the user to communicate a telephony call over the IP network and via the combination of a terminating gateway and the Public Switched Telephone Network (PSTN). The present invention supports three separate architectures, namely a proxy-based system model, a direct communication model, and a hybrid proxy/direct communication model. Each of the clearinghouse architectures will be described in more detail below in connection with the illustrations shown in FIGS. **2–7**.

Proxy-Based Model

End user devices can be incorporated into a clearinghouse service architecture through proxy systems. Proxy-based services interpose a proxy system between an end user device and a terminating gateway. Proxy systems typically include H.323 gatekeepers, Session Initiation Protocol (SIP) proxy servers, and proprietary devices.

A proxy-based model is fundamentally the same architecture as the existing phone-to-phone architecture; proxy-based architectural elements have exact analogs in the phone-to-phone case:

Phone-to-Phone	Proxy-Based End User Devices
Calling party's telephone	end user device
PSTN from calling party to originating gateway	network from end user device to proxy
Originating gateway	proxy system

The call scenario of FIG. **2** shows a representative example of proxy-based services in which the proxy system is gatekeeper compatible with the H.323 protocol. The operator of the proxy system is equivalent to the operator of an originating gateway. The key to this model is the existence of appropriate proxy systems. The proxy must interoperate with the clearinghouse service and be able to enroll with a clearinghouse service operator. The proxy must interoperate with terminating gateways. The proxy should not employ an interoperable call signaling protocol; instead, it must convey authorization tokens in an interoperable manner. The proxy must interoperate with end user devices. The protocol between end user devices and the proxy need not be the same as the protocol between the proxy and terminating gateways. Although the exemplary example of FIG. **2** illustrates an H.323 protocol implementation in both legs, end user devices could use SIP, or even a proprietary protocol to communicate with the proxy system.

The proxy-based architecture **200** shown in FIG. **2** comprises an intelligent end-user device, such as the H.323 terminal **205**, for communicating to a a proxy server **210** via the IP network **220**. For the example shown in FIG. **2**, the

proxy server is implemented as an H.323 protocol-compatible gatekeeper **210** capable of communicating with a service point **215** and a terminating gateway, such as the H.323 protocol-compatible gateway **225**, via the IP network **220**. Although FIG. **2** shows only a single terminating gateway, those skilled in the art will appreciate that proxy-based architecture **200** can include multiple terminating gateways capable of communicating with a proxy server. The service point **215** supports clearinghouse services for the Internet telephony system by providing the proxy server **210** with both authorization information and a list identifying one or more terminating gateways for accepting an incoming call from the user of the terminal **205**. Each terminating gateway **225** is coupled to the PSTN **230** to support the communication of an incoming call from the proxy server **210** to a called party at a telephone handset **235**.

The terminal **205** supports the operation of a client application that is configured to communicate with the proxy server **210** via the IP network **220**. To initiate an outgoing call to a called party, the user can enter the telephone for the called party at the client application operating on the terminal **205**. In response, the terminal **205** transmits call-related information, including the called number, to the gatekeeper **210**. The call-related information can include end-user authorization information and authentication information to support a determination of whether the user is authorized to complete an Internet telephony call via the proxy server **210**. The proxy server **210** completes the user validation task and, based upon validation of the user, transmits an authorization request to the service point **215** via the IP network **220**. This authorization request initiates a clearinghouse service operation by the service point **215**. The authorization request typically includes the called number and a call identifier to support a secure identification of the proxy server **210** as an authorized user of the clearinghouse service maintained by the service point **215**.

In response the to authorization request, the service point **215** determines whether the proxy server **210** is an authorized user of the clearinghouse services. If so, the service point **215** identifies each terminating gateway **225** that can accept the call to the called party from the calling party at the terminal **205**. In turn, the service point **215** can transmit an authorization response to the proxy server **210** via IP Nntwork **220**. The authorization response typically comprises the identity of each available terminating gateway and an authorization token for each identified terminating gateway. The identity of each terminating gateway is typically the IP address for the gateway.

In response to the authorization response, the proxy server **210** can select an identified terminating gateway **225** and set-up a call for handling by the selected terminating gateway. The set-up operation is typically completed by the proxy server **210** as an H.323 protocol set-up task and includes a communication comprising the call identifier, the authorization token for the identified terminating gateway and the called number. Although the proxy-based architecture shown in FIG. **2** is compatible with the H.323 protocol, it will be appreciated that the SIP protocol can be used to support communications by the proxy server **210** with the service point **215** and each terminating gateway **225**.

The proxy server **210** initiates the set-up operation by sending a set-up request to the selected terminating gateway **225**. The selected terminating gateway **225** will process the set-up information, including the call identifier, the authorization token, and the called number, to determine whether to accept completion of the call. The selected terminating gateway **225** will determine whether the authorization token is valid and has been issued by a known and verified clearinghouse service. In addition, the selected terminating gateway **225** will determine whether the authorization token has expired or remains within the time period authorized for completion of the call. The selected terminating gateway **225** also will determine whether the call number and the call identifier match the call information contained in the authoization token issued by the clearinghouse service. Based upon a positive response to this set of queries, the selected terminating gateway **225** will respond to the set-up communication by issuing an set-up acknowledgment to the proxy server **210**. The selected terminating gateway **225** will decline the processing of the call based upon a determination that the call information forwarded by the proxy server **210** is invalid.

In response to issuing the set-up acknowledgement, the terminating gateway **225** will complete the call communication to the called number via PSTN **230**. When the call is terminated by the called party at the telephone handset **235**, the selected terminating gateway **225** can report the call duration to the clearinghouse service operating at the service point **215** via IP network **220**. The service point **215** can confirm receipt of the call usage information by sending a confirmation message to the selected terminating gateway **225**.

To complete a call in the proxy-based architecture illustrated in FIG. **2**, the client application operating on the terminal **205** can accept a called a number from an end-user and can communicate with a gatekeeper, such as the proxy server **210**, via the IP network **220**. The proxy server **210** can handle all call-related communication with the clearinghouse service maintained at the service point **215** and call processing operations with a select gateway **225**. In essence, the proxy server **210** operates as a proxy for the client application at the terminal **205** by supporting all communications with the service point **215** and selected gateway **225**.

FIG. **3** is a logical flow chart diagram illustrating the exemplary steps completed by a proxy-based clearinghouse service for an Internet telephony system. Turning now to FIG. **3**, the proxy-based process **300** is initiated at step **305** in response to the user launching the client application at a terminal. The client application is configured to communicate with a proxy server via the IP network. For example, the client application can be implemented by the "NET MEETING" software program marketed by Microsoft Corporation of Redmond, Wash. In step **310**, the user can enter into the client application a telephone number for a party to be called via the IP network. The user typically enters the called number into the client application by completing a form or a web page presented to the user at the terminal **205**.

In step **315**, the client application completes a set-up operation with the proxy server by communicating user authorization and authentication information to the proxy server via the IP network. Typical information includes a password assigned to the end-user, namely the calling party, and call payment information, such as a calling card number. The client application is preferably programmed to complete transmission of set-up to the proxy server without manual assistance by the end-user.

In step **320**, represented by the client application, the proxy server completes an inquiry to determine whether the calling party is a valid user of the calling services at the proxy server. If the response to the inquiry is negative, the "NO" branch is followed from step **320** to step **325** and the call is terminated. Otherwise, the "YES" branch is followed to step **330**. The proxy server transmits in step **330** an

authorization request to a clearinghouse service server, such as a service point coupled to the IP network. The authorization request typically includes the called number and the call identifier.

In step **335**, the clearinghouse service server responds to the authorization request by completing a determination of whether the proxy server is valid and authorized to access the clearinghouse services maintained at the service point. If the proxy server is not authorized to access the services, the call is terminated at step **340**. A positive response to the inquiry in step **335** results in the clearinghouse service server transmitting an authorization response to the proxy server in step **345**. The authorization response typically includes an identity of one or more terminating gateways to handle the call from the end-user. In addition, the authorization response can include an authorization token for each identified terminating gateway.

The clearinghouse service server supports clearinghouse services for an Internet telephony system and is further described in a pending U.S. patent application assigned to the assignee of the present application, Ser. No. 09/154,564 entitled "Internet Telephone Call Reporting Engine" filed on Sep. 16, 1998. The subject matter of the '564 application is hereby fully incorporated within by reference.

In step **350**, the proxy server selects one of the identified terminating gateways and completes a set-up operation with a selected terminating gateway. The set-up request issued by the proxy server typically comprises a call identifier, an authorization token for the selected terminating gateway, and the called number. The set-up communications between the proxy server and the selected terminating gateway can be compatible with the H.323 protocol, the SIP protocol, or other known protocols.

In step **355**, the selected terminating gateway responds to the set-up request by completing a set-up operation to determine whether the proxy server is valid and has proper access to the services maintained by the terminating gateway. For example, the terminating gateway determines whether the authorization token has been issued by a known and valid clearinghouse service and is within the expiration period for a call communication. In addition, the selected terminated gateway can compare the called number and the call identifier to information maintained in the authorization token to determine whether the call-related information is valid. If the response to the inquiry in step **355** is negative, the "NO" branch is followed to **360** and the call is not accepted by the selected terminating gateway. If, on the other hand, the response to the inquiry in step **355** is positive, the "YES" branch is followed to step **365** and the terminating gateway issues a set-up acknowledgement to the proxy server. The selected terminating gateway also processes the call to the called number via the PSTN for communication to the called party.

In step **370**, the selected terminating gateway determines whether the call has been terminated by a called or calling party. If the response to the inquiry in step **370** is negative, the "NO" branch loops back to step **370** to initiate the monitoring task again. If call service has been terminated, "YES" branch is followed from step **370** to step **375**. The selected terminating gateway in step **375** reports the call duration to the clearinghouse service server via the IP network. In response, the clearinghouse service server transmits in step **380** a call termination confirmation to the selected terminating gateway via the IP network. This supports the proper invoicing of a party responsible for payment of the call service supported by the proxy-based architecture for a clearinghouse service in an Internet telephony network.

Direct Communication Model

The direct communication model eliminates the need for a proxy system by enabling end user devices to communicate directly with terminating gateways. In effect, the end user device acts as the combination of an originating gateway and calling user's telephone.

The direct communication model requires that end user devices themselves are interoperable with the clearinghouse services (and with terminating gateways). End user devices must be able to enroll with a clearinghouse service. Although this requirement is feasible for end user devices based on personal computer platforms, it may be problematic for other devices. Simple clients (such as PDAs, for example), however, may not have the processing power to efficiently implement the cryptographic components of a clearinghouse service.

Unlike proxy-based services, the direct communication model results in end users becoming customers of clearinghouse services. The sales, marketing, and support issues of this approach may be accommodated through a third-party sales agent. Other aspects are more fundamental, however, as this model can significantly increase both the number of customers and the number of enrolled devices, while at the same time reducing the average transaction volume per customer and per device.

FIG. **4** illustrates the direct communication architecture for a clearinghouse service in an Internet telephony system constructed in accordance with an exemplary embodiment of the present invention. Turning now to FIG. **4**, an end user device **405** can communicate directly with a clearinghouse service maintained at a service point **410** via an IP network **415**. In response to call-related information provided by the service point **410**, the end user device **405** can communicate with an identified gateway **420** to support the communication of a telephony call via the IP network **415**. If the terminating gateway determines that the calling party at the end user device **405** is a valid user of its call handling services, the gateway **420** can communicate the call to the called party at a telephone handset **430** via the PSTN **425**.

For the direct communication architecture shown in FIG. **4**, the end user device **405** operates in a manner similar to a source gateway of a conventional Internet telephony system. For example, the application program operating on the device **405** can accept a telephone number to be called and issues an authorization request to the service point **410** to initiate clearinghouse service operations. This authorization request typically comprises both the called number and a call identifier to support a verification of the end user by the clearinghouse service. If the clearinghouse service determines that the device **405** is authorized to access its services, the service point **410** can transmit an authorization response to the client program at the device **405** via the EP network. The authorization response typically comprises an identity of one or more available terminating gateways and an authorization token for each identified terminating gateway.

The client program operating at the device **405** can select a terminating gateway for handling the call and issues a set-up request to that selected gateway via the IP network **415**. This set-up request and the corresponding response by the selected terminating gateway can be implemented by the H.323 protocol or the SIP protocol. If the selected terminating gateway **420** determines that the application program at the device **405** is an authorized user of its services, the terminating gateway will issue a set-up acknowledgment message to the device **405** via the IP network **415**. In turn, the selected terminating gateway **420** can communicate the call to the called party at the telephone handset **430** via the PSTN **425**.

FIG. **5** is a logical flow chart diagram illustrating a direct communication process for a clearinghouse service in an Internet telephony network in accordance with an exemplary embodiment of the present invention. Turning now to FIG. **5**, a direct communication process **500** is initiated at step **505** in response to launching a client application at an end user device coupled to the IP network. The calling party can enter a called number into the client application at step **510**. The user typically accomplishes the entry of the number to be called by entering a telephone number into a form or Web page presented by the client application at the end user device. In response to entry of the called number, the client application can send an authorization request to a clearinghouse service server operating as a service point on the IP network. The authorization request typically comprises the called number and a call identifier to support a determination by the clearinghouse service of whether the client application is authorized to access its services.

An inquiry is conducted by the clearinghouse service server in step **520** to determine whether the client application is valid and authorized to access the clearinghouse services. If the response to this inquiry is negative, the "NO" branch is followed from step **520** to step **525**. The call service is terminated by the clearinghouse service server in step **525**. If, on the other hand, the response to the inquiry in step **520** is positive, the "YES" branch is followed from step **520** to step **530**. The clearinghouse service server transmits an authorization response in step **530** to the client application residing at the end user device via the EP network. The authorization response typically includes an identification of one or more available terminating gateways and an authorization token for each terminating gateway.

In response to the authorization response, the client application can select one of the identified terminating gateways to process the call on behalf of the end user. The client application completes the selection of the terminating gateway in step **535** based upon the list of available terminating gateways identified by the clearinghouse service server. The client application also issues in step **535** a set-up request to the selected terminating gateway to initiate the call processing operation. The set-up request can be formatted as an H.323-compatible or a SIP request. The set-up request typically comprises the call identifier, the authorization token for the selected terminating gateway and the called number.

In step **540**, the selected terminating gateway determines whether the client application is valid and authorized to access its call handling services. The validation process typically includes a determination of whether the authorization token has been issued by a known and valid clearinghouse service and whether the authorization token is within the expiration period. In addition, the terminating gateway can complete a comparison of the called number and the call ID to the authorization token to determine whether the call-related information matches content encoded within the authorization token. If the response to the inquiry in step **540** is negative, the "NO" branch is followed to step **545** and the terminating gateway terminates all call-related operations. If, on the other hand, the response to the inquiry in step **540** is positive, the terminating gateway can initiate a call to the called number via the PSTN in step **550**.

In step **555**, the selected terminating gateway conducts a monitoring operation to determine whether the call has been terminated by one of the parties to the call. If not, the "NO" branch is followed from step **555** to step **550** to begin the monitoring process anew. If the call has been terminated, the "YES" branch is followed from step **555** to step **560**. The selected terminating gateway reports the call duration to the clearinghouse service server in step **560**. The clearinghouse service server can confirm termination of the call by sending a usage confirmation message to the selected terminating gateway via the IP network.

Hybrid Proxy/Direct Communication Model

A third architectural model for end user devices combines aspects from both proxy-based and direct communications approaches. This hybrid model relies on a proxy system, but allows the end user device to contact terminating gateways directly.

FIG. **6** illustrates how a web-based application can take advantage of the hybrid model. The application program running on the end user device (which, can be implemented as a Java or ActiveX applet implementing the Session Initiation Protocol) initiates the call by contacting a web server. The web server, acting as a proxy, performs the authorization exchange with a clearinghouse service point. It passes the resulting call routing information, along with the authorization token, back to the applet at the end user's device. The end user's PC or web-enabled device contacts the terminating gateway directly.

Because the end user receives routing and authorization from a web server, the end user is forced to visit the web site for each call. As a tool for enhancing "stickiness," the entire application may be positioned as a service for web sites (especially portals) more than for end users. Also, effective integration with other features of the web site (e.g. contact managers) may allow convenience to overcome some of the objections based on the relatively poor quality of the personal computer multimedia experience.

The requirements for a hybrid architecture include the existence of appropriate interoperable proxies (e.g., devices that can communicate with clients and with clearinghouse services) and end user devices that are directly interoperable with terminating gateways. It may also be the case in this approach that the proxy server cannot return an accurate usage report. If that is true, then the clearinghouse service operator must rely strictly on the terminating gateway's usage details.

FIG. **6** is a block diagram illustrating the exemplary architecture for a hybrid proxy/direct communication architecture for a clearinghouse service in an Internet telephony system. Turning now to FIG. **6**, the hybrid proxy/direct communication architecture includes aspects of the proxy server model illustrated in FIG. **2** and the direct communication model illustrated in FIG. **4**. For the hybrid proxy/direct communication architecture **600**, a web-enabled device **605**, a web server **610**, a service point **615** and one or more terminating gateways **625** are coupled to an IP network **620**.

The web-enabled device **605** can initiate a call by transmitting a call request to the web server **610**. In response, the web server **610** completes call authorization tasks with the service point **615** via the IP network **620**. The service point **615** maintains the clearinghouse service and is responsible for identifying available terminating gateways to accept an incoming call and to authorize call operations supported by the web browser **610** and the web-enabled device **605**. For a verified call communication, the web server **610** can respond to the authorization response issued by the service point **615** by transmitting call routing the information and an authorization token to the web-enabled device **605**. The web-enabled device **605** can complete call set-up operations with an identified terminating gateway **625** via the IP

network **620**. In response to the completion of set-up operations, the selected terminating gateway **625** can process the call for delivery to the called party at the telephone handset **635** via the PSTN **630**.

FIG. **7** is a logical flow chart diagram illustrating the exemplary tasks of a hybrid proxy/direct communication process for a clearinghouse service in an Internet telephony system. Turning now to the exemplary task of the hybrid proxy/direct communication process **700**, a calling party can log into a proxy server via a web-enabled device. The proxy server is typically implemented by a Web server coupled to the IP network. In step **710**, inquiry is conducted by the proxy server to determine whether the user of the web-enabled device is authorized to access the call-related services maintained at the proxy server. If the response to this inquiry is negative, the "NO" branch is followed from step **710** to step **715** and the process is terminated. If the user is authorized to access services at the proxy server, the "YES" branch is followed from step **710** to step **720**. The proxy server creates in step **720** an authorization request based upon a telephone number to be called and a call identifier. The called number is supplied by the calling party during the log-in task completed in step **705**.

In step **725**, the proxy server transmits the authorization request to the clearinghouse service server. The clearinghouse service server responds in step **730** by determining whether the proxy server is valid and authorized to access the clearinghouse services maintained by the service point. The authorization request issued in step **720** by the proxy server is the first indication received by the clearinghouse service that a party desires to initiate a call via the IP network. Consequently, there is a need at the service point to securely identify the proxy server as a valid user of the clearinghouse services for processing the call-related information provided by the proxy server. If the clearinghouse service cannot verify that the proxy server is a valid user of its services, the call is terminated at step **735**. If the response to the inquiry in step **730** is positive, the clearinghouse service server transmits to the proxy server in step **740** the identity of one or more available terminating gateways and an authorization token for each identified gateway. This authorization response typically comprises a list of IP addresses for the available terminating gateways and an authorization token for processing each identified terminating gateway.

In step **745**, the proxy server launches a client application at the web-enabled device. The Web server can accomplish the launching of the client application by dynamically constructing a Web page to launch the client. For example, the "Call to: URL" command can be used to create a link to a selected terminating gateway. The "Call to: URL" command can be used with Microsoft's "NET MEETING" protocol to create the link and to provide the authorization token and the call identifier to the client application. The user at the Web-enabled device can launch the client application by "clicking" or otherwise selecting the link to the selected terminating gateway.

In step **750**, the client application at the web-enabled device can complete call set-up operations with the identified terminating gateway. The typical H.323 set-up operation includes the transmission of a call identifier, an authorization token, and a called number to the selected terminating gateway via the IP network. This set-up request can be formatted to comply with the H.323 protocol or the SIP protocol.

In step **755**, the selected terminating gateway conducts an inquiry to determine whether the set-up request issued by the client application represents a valid call service request. The terminating gateway typically validates the client application by determining whether the authorization token has been issued by a known and valid clearinghouse service and is within the expiration period. In addition, the selected terminating gateway can compare the called number and the call identifier to information encoded within the authorization token to determine whether a match exists for a valid client application. If the response to the inquiry in step **755** is negative, the "NO" branch is followed from step **755** to step **760** and the call is terminated. If the selected terminating gateway verifies that the call service request has been issued by a valid client application, the "YES" branch is followed to step **765**.

In step **765**, the selected terminating gateway completes the call to the called number via the PSTN.

In step **770**, the selected terminating gateway monitors the completed call to determine whether a call service has been terminated by a party to the call. If the response to this monitoring task is negative, the "NO" loop is followed back to step **770** to continue monitoring operations. If, on the other hand, the call has been terminated, the selected terminating gateway can report the call duration to the clearinghouse service server via the IP network in step **775**. In turn, the clearinghouse service server can transmit a call termination confirmation in step **780** to the selected terminating gateway.

In view of the foregoing, it will be understood that the present invention provides clearinghouse services architectures that support the use of end user devices, such as personal computers, IP phones, cable multimedia terminal adapters, and residential gateways, in an Internet telephony system. A user can operate an "intelligent" end user device, i.e., a device running a client program with knowledge of the architecture particulars, to access a clearinghouse service on an IP network. This enables the user to communicate a telephony call over the IP network and via the combination of a terminating gateway identified by the clearinghouse service and the PSTN. Significantly, the use of an intelligent end user device means that the user does not require direct access to architecture information necessary to communicate with the clearinghouse service; this information is maintained at the client application or a proxy. In addition, the present invention includes the forwarding of an authorization token to a selected terminating gateway by either a client application or a proxy. This authorization token provides an advantageous method for securely verifying that the contacting entity is a valid user of the clearinghouse service. The present invention supports three innovative architectures, namely a proxy-based system model, a direct communication model, and a hybrid proxy/direct communication model.

I claim:

1. A computer-implemented method for providing clearinghouse services to a client device in an Internet Protocol (IP) telephony system, comprising the steps of:

transmitting a call set-up request for a call communication to a proxy server from a client application operating on the client device, the call set-up request comprising a called number for the call communication and user authentication information, the client device and the proxy server coupled to an IP network;

determining if the client application is a valid user of the services maintained at the proxy server, then transmitting an authorization request from the proxy server to a clearinghouse service running on a service point

coupled to the IP network if the client application is a valid user, the clearinghouse service being accessible only by the proxy server and one or more gateways, the authorization request comprising the called number and a call identifier; determining if the proxy server is a valid user of the clearinghouse services, then transmitting an authorization response from the service point to the proxy server via the IP network if the proxy server is a valid user, the authorization response comprising the identity of one or more terminating gateways coupled to the IP network and available to deliver the call communication and an authorization token for each identified terminating gateway;

selecting one of the terminating gateways with the proxy server to deliver the call communication and transmitting via the proxy server a call communication set-up request to the selected terminating gateway via the IP network, the set-up request comprising the called number, the call identifier, and the authorization token; and

determining if the proxy server is a valid user of call delivery services of the selected terminating gateway, then delivering the call communication via the selected terminating gateway to the Public Switched Telephone Network (PSTN) if the proxy server is a valid user.

2. The method of claim 1, wherein the user authentication information comprises a pass-word.

3. The method of claim 1, wherein the user authentication information comprises payment information.

4. The method of claim 1, further comprising terminating the call set-up request if the client application is not a valid user of the services maintained at the proxy server.

5. The method of claim 1, wherein transmitting via the proxy server a call communication set-up request to the selected terminating gateway via the IP network further comprises formatting the set-up request according to one of a H.323 and SIP protocol.

6. The method of claim 1, wherein determining if the proxy server is a valid user of the call delivery services of the selected terminating gateway further comprises determining if the authorization token has been issued by a known and valid clearinghouse service.

7. The method of claim 1, wherein determining if the proxy server is a valid user of the call delivery services of the selected terminating gateway further comprises determining if the authorization token has been issued within an expiration period.

8. The method of claim 1, wherein determining if the proxy server is a valid user of the call delivery services of the selected terminating gateway further comprises comparing the called number and the call identifier to information maintained in the authorization token.

9. A computer-implemented method for providing clearinghouse services to a client device in an Internet Protocol (IP) telephony system, comprising the steps of:

transmitting a call set-up request for a call communication to a proxy server from the client device, the call set-up request comprising a called number for the call communication and user authentication information, the client device and the proxy server coupled to an IP network;

determining if the client application is a valid user of the services maintained at the proxy server, then transmitting an authorization request from the proxy server to a clearinghouse service running on a service point coupled to the IP network if the client application is a valid user, the service point being inaccessible by the client application, the authorization request comprising the called number and a call identifier;

determining if the proxy server is a valid user of the clearinghouse services, then transmitting an authorization response from the service point to the proxy server via the IP network if the proxy server is a valid user, the authorization response comprising the identity of one or more terminating gateways coupled to the IP network and available to deliver the call communication and an authorization token for each identified terminating gateway;

launching a client application at the client device and routing the identity of each terminating gateway and each authorization token from the proxy server to the client application;

selecting one of the terminating gateways with the client application to deliver the call communication and transmitting via the client application a call communication set-up request to the selected terminating gateway via the IP network, the set-up request comprising the called number, the call identifier, and the authorization token; and

determining if the client application is a valid user of the call delivery services of the selected terminating gateway, then delivering the call communication via the selected terminating gateway to the Public Switched Telephone Network (PSTN) if the client application is a valid user.

10. The method of claim 9, further comprising terminating the call set-up request if the client application is not a valid user of the services maintained at the proxy server.

11. The method of claim 9, wherein determining if the proxy server is a valid user of the clearinghouse services further comprises establishing a secure communications link between the proxy server and the service point and evaluating the proxy server with the service point.

12. The method of claim 9, wherein launching a client application at the client device further comprises dynamically constructing a web page.

13. The method of claim 9, wherein transmitting via the client application a call communication set-up request to the selected terminating gateway via the IP network further comprises formatting the set-up request according to one of a H.323 and SIP protocol.

14. The method of claim 9, wherein the user authentication information comprises a pass-word.

15. The method of claim 9, wherein the user authentication information comprises payment information.

16. The method of claim 15, wherein the payment information comprises a calling card number.

17. A system for providing clearinghouse services to a client device, comprising:

an IP network;

a proxy server;

a service point;

one or more gateways;

a Public Switched Telephone Network (PSTN); and

a client device for transmitting a call set-up request for a call communication to the proxy server from a client application running on the client device, the client device and the proxy server coupled to the IP network; the proxy server determining if the client application is a valid user of the services maintained at the proxy server and transmitting an authorization request to a clearinghouse service running on the service point if

the client application is a valid user; the clearinghouse service being accessible only by the proxy server and the one or more gateways; the service point determining if the proxy server is a valid user of the clearinghouse services and transmitting an authorization response to the proxy server if the proxy server is a valid user; the one or more gateways determining if the proxy server is a valid user of call delivery services and delivering call communications via the one or more terminating gateways to the Public Switched Telephone Network (PSTN) if the proxy server is a valid user.

18. The system of claim **17**, wherein the authorization request comprises a called number and a call identifier.

19. The system of claim **17**, wherein the authorization response comprises the identity of the one or more terminating gateways coupled to the IP network and available to deliver the call communication and an authorization token for each identified terminating gateway.

20. The system of claim **17**, wherein the call set-up request comprises a called number for the call communication and user authentication information.

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